Ref No:			

SRI KRISHNA INSTITUTE OF TECHNOLOGY, BANGALORE



COURSE PLAN

Academic Year 2019

Program:	B E		
Semester :	2		
Course Code:	18MAT21		
Course Title:	Advanced Calculus and Numerical Methods		
Credit / L-T-P:	4 / 3-2-0		
Total Contact Hours:	50		
Course Plan Author: Veeresha A Sajjanara			

Academic Evaluation and Monitoring Cell

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2. Concepts and Outcomes	
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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:	CV/ISE
Semester:	2	Academic Year:	2018-19
I Alirca Litia:	Advanced Calculus and Numerical Methods	Course Code:	18MAT21
	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	100 Marks
CIA Marks:	50 Marks	Assignment	1 / Module
Course Plan Author:	Veeresha A Sajjanara	Sign	Dt:
Checked By:	Pavani A	Sign	Dt:
CO Targets	CIA Target: %	SEE Target:	%

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		Teachi		Blooms
ule		ng	Module	Learning
		Hours		Levels
	Scalar and Vector fields, Gradient, directional derivative, curl and divergence-physical interpretation: solenoidal and irrotational vector fields-illustrative problems.		Vector Differentiation	L3
	Line Integrals, Theorems of Green, Gauss and Stokes(without proof). Applications to work done by force and flux.		Vector Integration	L3
	Second order Linear ODE's with constant coefficients- Inverse differential operators, method of variation of parameters.		Ordinary Differential equation	L3
	Cauchy's and Legendre homogeneous equations. Applications to oscillations of a spring and L-C-R circuits.		Ordinary Differential equation	L3
3	Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables.		Partial Differential equation	L3
3	Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables.		Partial Differential equation	L3
	Series of positive terms-convergence and divergence. Cauchy's root test and D'Alembert's ratio test(without proof)-illustrative examples.		Infinite series	L3
	Series solution of Bessel's differential equation leading to Jn(x)-Bessel's function of first kind-orthogonality. Series solution of Legendre polynomials. Rodrigue's formula(without proof),problems.		Power series	L3
	Finite differences, Interpolation/extrapolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae(All formulae without proof).		Numerical methods	L3
5	Solution of polynomial and transcendental equations-	5	Numerical	L3

Ī	-	Total	54	-	-
		Newton-Raphson and Regula-Falsi methods(only formulae)-illustrative examples.Simpson's (1/3) rd and (3/8) th rules, Weddle's rule(without proof)-Problems.		methods	
		Navitas Daulaas and Davila Fala: saathada/asli			

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.

	earch: Recent developments on the concepts - publications in journ		
Modul	Details	Chapter	Availability
es		s in	
		book	
	Text books (Title, Authors, Edition, Publisher, Year.)	-	-
	B.S.Grewal: Higher Engineering Mathematics, Khanna publishers,	1,2,10	In Dept
	43 rd Ed.,2015.		
2	E.Kreyszig: Advanced Engineering Mathematics,John Wiley &		Not Available
	Sons, 10 th Ed.(Reprint),2016.		
В	Reference books (Title, Authors, Edition, Publisher, Year.)	-	-
1	C Ray Wylie, Louis C Barrett: "Advanced Engineering		Not Available
	Mathematics",6th Edition, 2.McGraw-Hill Book Co.,New york,1995.		
2	James Stewart:"Calculus- Early Transcendentals", Cengage		Not Available
	Learning India Private Ltd.,2017.		
	B.V.Ramana:"Higher Engineering Mathematics" 11th Edition Tata	1,5,6,7	In Dept
	McGraw-Hill,2010.		
4	Srimanta Pal & Subobh C Bhunia: "Engineering Mathematics",		Not Available
	Oxford UniversityPress, 3 rd Reprint, 2016.		
	Gupta C B, Singh S R and Mukesh Kumar:"Engineering		Not Available
	Mathematics for Semesterl and II, Mc-Graw Hill		
	Education(India)Pvt.Ltd., 2015.		
	Concept Videos or Simulation for Understanding	-	-
C1	https://nptel.ac.in/course.html		
C2	http://www.class-central.com/subject/maths		
C3	http://academicearth.org/		
C4	e-learning@vtu		
C5	e-shikshana@vtu		
D	Software Tools for Design	-	-
E	Recent Developments for Research	-	-
	Othors (Wale Video Cimulation Nationals)		
F	Others (Web, Video, Simulation, Notes etc.)	-	-

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 . . .

Juan	stadents mast have reame the following courses, ropies with described content									
Mod ules		Course Name	Topic / Description	Sem	Remarks	Blooms Level				

-				
-				

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.

		1		
Mod	Topic / Description	Area	Remarks	Blooms
Mod ules				Level
1				
3				
3				
5				
-				
-				

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.#		Hours		Method	ent	Level
		student should be able to .				Method	
1	18MAT21	Illustrate the applications of		Vector	Lecture		L2
		multivariate calculus to understand the solenoidal		Differentia tion		ent and slip test	
		and irrotational vectors.		CIOII		slip test	
1	18MAT21	Exhibit the interdependence		Vector	Lecture	Assignm	L3
		of line, surface and volume integrals.		Integratio n		ent and slip test	
2	18MAT21	Demonstrate various physical	5	Ordinary	Lecture	Assignm	L3
		models through higher order		Differentia		ent and	
		differential equations and				slip test	
		solve such linear .Ordinary differential equation.		equations			
2	18MAT21	To study the behaviour of		Ordinary	Lecture		L3
		LCR circuits and oscillations		Differentia		ent and	
		of springs using Ordinary differential equation		l equations		slip test	
		·					
3	18MAT21	Construct a variety of partial	6	Partial	Lecture	Assignm	L3
		differential equations.		Differentia		ent and slip test	
				equations		Ship test	
3	18MAT21	To find solution by exact		Partial	Lecture		L3
		methods/method of separation of variables.		Differentia		ent and slip test	
		separation of variables.		equations		slip test	
4	18MAT21	To explain the applications of	5	Infinite	Lecture	Assignm	L3
		infinite series.		series		ent and	
4	18MAT21	To obtain series solution Of	5	Power	Lecture	slip test Assignm	L3
	101-1/(121	Ordinary differential equation.		series	Lecture	ent and	
						slip test	

5		Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.		Numerical methods	Lecture	Assignm ent and slip test	
5		Numerical integration comprises a broad of algorithms for calculating the numerical value of definite integral.		Numerical methods		Assignm ent and slip test	
-	-	Total	50	-	-	-	

2. Course Applications

Write 1 or 2 applications per CO.

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

9-0-0-0	ents should be able to employ / apply the course learnings to		
Mod	Application Area	CO	Level
ules	Compiled from Module Applications.		
1	Used extensively in physics and engineering especially in the description of	1	
	electromagnetic fields, gravitational fields and fluid flow.		L3
1	Used in computational electrodyanmics simulation.	2	L3
2	Used in computational fluid dynamics	3	L3
2	Used in studying the behaviour of LCR circuits and oscillations of springs	4	L3
3	It is used to describe a wide variety of phenomena such as sound, heat and	5	L3
	diffusion.		
3	It is used to describe a wide variety of phenomena such as	6	L3
	electrostatics,electrodynamics and quantum mechanics.		
4	It is used for analysis of current flow and sound waves in electric circuits.	7	L3
4	It is used in nuclear engineering analysis.	8	L3
5	Used in network simulation and weather prediction	9	L3
5	Used in computer science for root algorithm and multidimensional root	10	L3
	finding.		

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.

Mod ules		ping	Mapping Level	Justification for each CO-PO pair	Lev el
-	СО	РО	-	'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'	-
1	CO1	PO1		'Engineering Knowledge:' - Acquisition of Knowledge of Vector Differentiation is essential to accomplish solutions to complex engineering problems.	L3
1	CO1	PO2		'Problem Analysis': Analyzing problems require knowledge / understanding of Vector Differentiation accomplish solutions to complex engineering problems .	L3
1	CO1	PO3		'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Vector Differentiation to accomplish solutions to complex engineering problems.	L3
1	CO1	PO4		Conduct investigations of complex engineering problems: using research based knowledge and research methods in vector Differentiation to accomplish solutions to complex engineering problems.	L3
1	CO1	PO9		Individual and team work: Function effectively as an individual in multidisciplinary settings using vector Differentiation to achieve solutions to complex engineering problems.	L3
1	CO1	PO11		Project management and finance: Demonstrate knowledge to manage projects using vector Differentiation to attain solutions to	L3

-	601	DO12		complex engineering problems.	1.3
1	COI	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using vector Differentiation.	L3
1	CO2		L3	'Engineering Knowledge:' - Acquisition of Knowledge of Vector Integration is essential to accomplish solutions to complex engineering problems.	L3
1	CO2		L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Vector Integration accomplish solutions to complex engineering problems .	L3
1	CO2		L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Vector Integration to accomplish solutions to complex engineering problems.	L3
1	CO2	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in vector Integration to accomplish solutions to complex engineering problems.	L3
1		PO10	L3	Communication: Communicate effectively on complex engineering activities using vector integration.	L3
1		PO11	L3	Project management and finance: Demonstrate knowledge to manage projects using vector Integration to attain solutions to complex engineering problems.	L3
1		PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using vector Integration.	L3
2	CO3	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Ordinary differential equations is essential to accomplish solutions to complex engineering problems.	L3
2	CO3		L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Ordinary differential equations accomplish solutions to complex engineering problems .	L3
2	CO3	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Ordinary differential equations to accomplish solutions to complex engineering problems.	L3
2	CO3	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Ordinary differential equations to accomplish solutions to complex engineering problems.	L3
2	CO3	PO9	L3	Individual and team work: Function effectively as an individual in multidisciplinary settings using Ordinary differential equations to achieve solutions to complex engineering problems.	L3
2	CO3	PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Ordinary differential equations to attain solutions to complex engineering problems.	L3
2	CO3	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Ordinary differential equations.	L3
2	CO4	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Ordinary differential equations is essential to accomplish solutions to complex engineering problems.	L3
2	CO4	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Ordinary differential equations accomplish solutions to complex engineering problems .	L3
2	CO4	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Ordinary differential equations to accomplish solutions to complex engineering problems.	L3
2	CO4	PO4	L3	Conduct investigations of complex engineering problems: using	L3

				research based knowledge and research methods in Ordinary	
				differential equations to accomplish solutions to complex	
2	CO4	PO9	L3	engineering problems. Individual and team work: Function effectively as an individual in	L3
۷	C04	109	LJ	multidisciplinary settings using Ordinary differential equations to achieve solutions to complex engineering problems.	
2	CO4	PO11	L3	Project management and finance:Demonstrate knowledge to	L3
				manage projects using Ordinary differential equations to attain solutions to complex engineering problems.	
2	CO4	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Ordinary differential equations.	L3
3	CO5	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Partial Differential equations is essential to accomplish solutions to complex engineering problems.	L3
3	CO5	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Partial Differential equations accomplish solutions to complex engineering problems.	L3
3	CO5	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Partial Differential equations to accomplish solutions to complex engineering problems .	L3
3	CO5	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Partial Differential equations to accomplish solutions to complex engineering problems.	L3
3	CO5	PO10	L3	Communication: Communicate effectively on complex engineering activities using Partial Differential equations.	L3
3	CO5	PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Partial Differential equations to attain solutions to complex engineering problems.	L3
3	CO5	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Partial Differential equations.	L3
3	CO6	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Partial differential equations is essential to accomplish solutions to complex engineering problems.	L3
3	CO6	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Partial differential equations accomplish solutions to complex engineering problems .	L3
3	CO6	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Partial differential equations to accomplish solutions to complex engineering problems.	L3
3	CO6	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Partial differential equations to accomplish solutions to complex engineering problems.	L3
3	CO6	PO9	L3	Individual and team work: Function effectively as an individual in multidisciplinary settings using Partial differential equations to achieve solutions to complex engineering problems.	L3
3		PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Partial differential equations to attain solutions to complex engineering problems.	L3
3	CO6	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Partial differential equations.	L3
4	CO7	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Infinite series is essential to accomplish solutions to complex engineering	L3

				problems.	
4	CO7	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Infinite series accomplish solutions to complex engineering problems.	L3
4			L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Infinite series to accomplish solutions to complex engineering problems .	L3
4			L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Infinite series to accomplish solutions to complex engineering problems.	L3
4		PO9	L3	Individual and team work: Function effectively as an individual in multidisciplinary settings using Infinite series to achieve solutions to complex engineering problems.	
4		PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Infinite series to attain solutions to complex engineering problems.	L3
4	CO7	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Infinite series .	L3
4	CO8	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Power series is essential to accomplish solutions to complex engineering problems.	L3
4	CO8	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Power series accomplish solutions to complex engineering problems.	L3
4	CO8	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Power series to accomplish solutions to complex engineering problems.	L3
4			L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Power series to accomplish solutions to complex engineering problems.	L3
4	CO8	PO9	L3	Individual and team work: Function effectively as an individual in multidisciplinary settings using Power series to achieve solutions to complex engineering problems.	L3
4	CO8	PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Power series to attain solutions to complex engineering problems.	L3
4	CO8	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Power series.	L3
5	CO9	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Numerical Methods is essential to accomplish solutions to complex engineering problems.	L3
5	CO9	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Numerical Methods accomplish solutions to complex engineering problems.	L3
5	CO9	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Numerical Methods to accomplish solutions to complex engineering problems.	L3
5	CO9	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Numerical Methods to accomplish solutions to complex engineering problems.	L3
5	CO9	PO10	L3	Communication: Communicate effectively on complex engineering activities using Numerical Methods.	L3
5	CO9	PO11	L3	Project management and finance:Demonstrate knowledge to manage projects using Numerical Methods to attain solutions to complex engineering problems.	L3
5	CO9	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Numerical Methods .	L3

5	CO1 0	PO1	L3	'Engineering Knowledge:' - Acquisition of Knowledge of Numerical Methods is essential to accomplish solutions to complex engineering problems.	L3
5	CO1 0	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding of Numerical Methods accomplish solutions to complex engineering problems .	L3
5	CO1 0	PO3	L3	'Design / Development of Solutions': Design & development of solutions require knowledge / understanding & analysis Numerical Methods to accomplish solutions to complex engineering problems.	L3
5	CO1 0	PO4	L3	Conduct investigations of complex engineering problems: using research based knowledge and research methods in Numerical Methods to accomplish solutions to complex engineering problems.	L3
5	CO1 0	PO9	L3	Individual and team work: Function effectively as an individual in multidisciplinary settings using Numerical Methods to achieve solutions to complex engineering problems.	L3
5	0	PO11		Project management and finance:Demonstrate knowledge to manage projects using Numerical Methods to attain solutions to complex engineering problems.	L3
5	CO1 0	PO12	L3	Life-long learning: Recognize the need for life- long learning with practical applications in engineering field using Numerical Methods.	L3

4. Articulation Matrix

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

-	-	Course Outcomes					Pr	ogr	am	Οι	utc	om	es					-
Mod	CO.#	At the end of the course	PO	PO	Р	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS	Lev
ules		student should be able to .	1	2	O	4	5	6	7	8	9	10	11	12	01	02	О3	el
					3													
1	18MAT21.	Illustrate the applications of		2.5	2.	2.5					2.5		2.5	2.5				L3
		multivariate calculus to			5													
		understand the solenoidal and																
-		irrotational vectors.	2 -	2.5	_	2 -						2 -	2 -	2 -				
1		Exhibit the interdependence of line, surface and volume		2.5	۷.	2.5						2.5	2.5	2.5				L3
		integrals.			3													
2		Demonstrate various physical	2 5	2 5	2	2 5					2.5		25	2.5				L3
_		models through higher order		2.5	5	2.5					2.5		2.5	2.5				
		differential equations and																
		solve such linear .Ordinary																
		differential equation.																
2	18MAT21.	To study the behaviour of	2.5	2.5	2.	2.5					2.5		2.5	2.5				L3
		LCR circuits and oscillations of			5													
		springs using Ordinary																
		differential equation																
3	18MAT21	Construct a variety of partial	25	2 5	2	25						2 5	25	2.5				L3
	5	differential equations.	2.5	2.5	5	2.5						2.5	د.ے	د.ے				LJ
3		To find solution by exact	2.5	2.5	2.	2.5					2.5		2.5	2.5				L3
		methods/method of			5													
		separation of variables.																
4		To explain the applications of	2.5	2.5	2.	2.5					2.5		2.5	2.5				L3
		infinite series.			5													
4		To obtain series solution Of		2.5	2.	2.5					2.5		2.5	2.5				L3
		Ordinary differential equation.			5													
5		Apply the knowledge of		2.5	2.	2.5						2.5	2.5	2.5				L3
		numerical methods in the			5													
		modeling of various physical and engineering phenomena.																
		and engineering phenomena.																

5	18MAT21.	Numericalintegration	2.5	2.5	2.	2.5					2.5		2.5	2.5				L3
		comprises a broad o	F		5													
		algorithms for calculating the	•															
		numerical value of definite	•															
		integral.																
-	CS501PC	Average attainment (1, 2	,															-
		or 3)																
-		1.Engineering Knowledge; 2																
		Solutions; 4.Conduct Investi	gati	ions		of .	Cor	npi	<i>lex</i>	Pr	obl	lem	ıs;	5.1	Mod	deri	n = 1	ΓοοΙ
		Usage; 6.The Engineer and So	cie	ty; i	7.E	nvi	iron	me	ent	an	d 5	ust	ain	abi	lity	; 8.	Eth	ics;
		9.Individual and Teamwork;	10.0	Čorr	ım	uni	cat	ion	; 1	1.F	roje	ect	M	ana	ige.	mei	nt .	and
		Finance; 12.Life-long Learn	ing;	. 5	1.	Sof	twa	re	E	ngi	née	rin	g;	52	$2.D_{i}$	ata	В	ase
		Management; S3.Web Design								_			-					

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					
1					
2					

6. Content Beyond Syllabus

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

Mod ules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1						
1						

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.

Jeau										
Mod	Title	Teach		No. of	quest	ion in	Exam		CO	Levels
ules			CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
		Hours					Asg			
1	Vector Calculus	10	2	-	-			2		L3
2	Differential Equations of higher	10	2	-	-			2		L3
	order									
3	Partial Differential equations	10	-	2	-			2		L3
4	Infinite and Power series	10	-	2	-			2		L3
5	Numerical Methods and	10	-	-	4			2		L3
	Integration									
-	Total	50	4	4	4			10	-	-

2. Continuous Internal Assessment (CIA)

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

	· ··= ·			
Mod		Weightage	СО	Levels
ules		in Marks		
1	CIA Exam - 1	30	CO1, CO2, CO3,Co4	L3,L3,L3,L3
2	CIA Exam - 2	30	CO5, CO6, CO7, C08	L3,L3,L3,L3
3	CIA Exam - 3	30	CO9, CO10	L3, L3

	Final CIA Marks	40	-	-
3	Assignment - 3	10	CO9, CO10	L3,L3
2	Assignment - 2	10	CO5, CO6, CO7, C08	L3,L3,L3,L3
1	Assignment - 1	10	CO1, CO2, CO3,Co4	L3,L3,L3,L3

D1. TEACHING PLAN - 1

Title:	Vector Calculus	Appr	12 Hrs
	Course Outcomes	Time:	Bloom
а	Course Outcomes	CO	S
	The student should be able to:	-	Level
1	Illustrate the applications of multivariate calculus to understand the	CO1	L3
	solenoidal and irrotational vectors and also exhibit the interdependence		
b	of line , surface and volume integrals. Course Schedule		
Class	Portion covered per hour		_
No	i ortion covered per noui		_
1	Scalar and Vector fields,	CO1	L3
2	Gradient, directional derivative	CO1	L3
3	curl and divergence-physical interpretation	CO1	L3
4	solenoidal and irrotational vector fields-illustrative problems.	CO1	L3
5	Line Integrals	CO1	L3
6	Theorems of Green, Gauss and Stokes(without proof).	CO2	L3
7	Applications to work done by force and flux.	CO2	L3
c	Application Areas Used extensively in physics and engineering especially in the	1	L 3
1	description of electromagnetic fields, gravitational fields and fluid flow.	T	LS
1	Used in computational electrodyanmics simulation.	2	L3
d	Review Questions	-	-
1	If $\vec{F} = \nabla(x y^3 z^2)$ Find div \vec{F} and curl \vec{F} at the point (1, -1, 1)	CO.1	L3
2	Find the angle between the surfaces $\chi^2 + \chi^2 + \chi^2 = 9$ and	CO.1	L3
	$z=x^2+y^2-3$ at (2,-1,2)		
3	Find the directional derivative of $\varphi = x^2 yz + 4 xz^2$ at(1, -2, -1) in the	CO.1	L3
	direction of 2i-j-2k.		
4	Find the work done in moving a particle in the force field	CO.1	L3
	$\vec{F} = 3x^2i + (2xz - y)j + zk$ along the straight line from (0,0,0) to (2,1,3)		
5	Use the divergence theorem to evaluate $\iint_{\Gamma} \vec{F} \cdot \hat{n} ds$. Find the flux	CO.1	L3
	Use the divergence theorem to evaluate $\iint_S T dt$. Find the flux		
	across the suface, S is the rectangular parallelopiped bounded by		
	$x=0,y=0,z=0,x=2,y=1,z=3$ where $\vec{F}=2xyi+yz^2j+xzk$		
	. 5,, 5,2 5,0 2,1 2,12 5 1 - 2xyl+ y Z J+xZK		
6	Evaluate by Stokes theorem $\oint (sinzdx - cosxdy + sinydz)$ where c is the	CO.1	L3
	$\varphi_{(SinZux)} = cosxuy + sinyuz$		
	boundary in the rectangle $0 \le x \le \pi$, $0 \le y \le 1$, $z=3$		
7	Derive an expression for radius of curvature in case of the polar curve $r=f(\theta)$.	CO.1	L3
8	Find the radius of curvature at the point 't' on the curve	CO.1	L3
	x= a(t+sint), $y= a(1-cost)$.		

Module - 2

Title:	Differential Equations of higher order	A 10 10 15	7 Hrs
Title:	Differential Equations of higher order	Appr Time:	/ HIS
а	Course Outcomes	СО	Bloom
	The student should be able to:		S Level
1	Demonstrate various physical models through higher order differential	CO 3	Levei L3
	equations and solve such linear ordinary differential equations.	CO.3	LJ
b	Course Schedule	-	-
Class No	Portion covered per hour	-	-
1	Second order Linear ODE's with constant coefficients	CO.3	L3
	Inverse differential operators,		
2	method of variation of parameters	CO.3	L3
3	Cauchy's homogeneous equations	CO.3	L3
4	Cauchy's homogeneous equations	CO.3	L3
5	Legendre homogeneous equations	CO.4	L3
6	Legendre homogeneous equations	CO.4	L3
7	Applications to oscillations of a spring	CO.4	L3
8	Applications to L-C-R circuits.	CO.4	L3
9	Applications to L-C-R circuits.	CO.4	L3
С	Application Areas	CO	Level
c 2	Application Areas Used in computational fluid dynamics	CO	Level
		3	
2 2	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs	3	L3
2 2 d	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions	3 4	L3 L3
2 2 d 1	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs	3	L3
2 2 d	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions	3 4	L3 L3
2 2 d 1	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ Solve $6y'' + 17y' + 12y = e^{-x}$	3 4 CO.3	L3 L3
2 2 d 1	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ Solve $6y'' + 17y' + 12y = e^{-x}$	3 4 CO.3	L3 L3 L3
2 2 d 1 2 3	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$	3 4 CO.3 CO.3	L3 L3 L3 L3
2 2 d 1 2 3	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. Solve $6y'' + 17y' + 12y = e^{-x}$ Solve $y'' - 4y' + 13y = Cos2x$ Solve $y'' + 2y' + 5y = e^{-x}Sin2x$. Solve $y'' - 2y' + y = xe^xSinx$	CO.3 CO.3 CO.3	L3 L3 L3 L3 L3
2 2 d 1 2 3 4 5	Used in computational fluid dynamics Used in studying the behaviour of LCR circuits and oscillations of springs Review Questions Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. Solve $6y'' + 17y' + 12y = e^{-x}$ Solve $y'' - 4y' + 13y = Cos2x$	CO.3 CO.3 CO.3 CO.4	L3 L3 L3 L3 L3 L3

E1. CIA EXAM - 1

a. Model Question Paper - 1

Crs		18MAT21	Sem:	1	Marks:	50	Time:	1.30 minutes		
Cod	ode:									
Cou	rse:	Advanced	Calculus ar	nd Numeric	al Methods					
-	-	Note: Ans	Note: Answer any 3 questions, each carry equal marks.						CO	Mark
		1	_	_						
										>
1	а	$d^2 y$	dy				dx	CO3	L3	6
1	а	Solve $\frac{d^2x}{d^2x}$	$+4\frac{dx}{h}+29$	x=0. Find	y when x(0)=0 and	$\frac{dx}{dt}(0) = 15$	CO3	L3	6

	b	Solve $(D^3+D^2-4D-4)y=3e^{-x}-4x-6$	CO3	L3	6
	С	Solve by the method of variation of parameters	CO3	L3	6
		$d^2y = c dy + 0 = e^{3x}$			
		$\left \frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 9 \right y = \frac{e^{3x}}{x^2}$			
	d	Solve $x^2 y'' + 5xy' + 13 y = logx + x^2$	CO3	L3	7
		OR			
2	а	J ² J.	CO3	L3	6
	"	Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$	003	LJ	U
	1-	en en	602		-
	b	Solve by the method of variation of parameters $y'' - y = \frac{2}{y''}$	CO3	L3	6
		Solve by the method of variation of parameters $y'' - y = \frac{2}{1 + e^x}$			
	С	Solve $(D^4 + 8D^2 + 16) y = 2\cos^2 x$	CO3	L3	6
	اما		602	1.2	7
	d	Solve $(3x+2)^2 y'' + 3(3x+2) y' - 36 y = 8x^2 + 4x + 1$	CO3	L3	/
3	а	J ² J	CO3	L3	6
]	"	$\left \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + 10 y + 37 \sin 3 x = 0. Find y \right $	003	LJ	U
		$dx^2 = dx$			
	b	Obtain the PDE by eliminating the arbitrary function	CO5	L3	6
		z=f(x+at)+g(x-at)			
	С	x^2	CO5	L3	6
		Form a PDE by eliminating arbitrary constants $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$			
		u b c			
	d	$\partial^2 z = X$	CO5	L3	7
		Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$ subject to the conditions $\frac{\partial z}{\partial x} = logx$ when			
		y=1 and $z=0$ at $x=1$.			
		OR OR	000		
4	а	Solve $(D^3 + 3D^2)x = 1 + t$	CO3	L3	6
	l_		COL	1.3	
	b	Obtain the PDE of the function $\varphi(xy+z^2,x+y+z)=0$	CO5	L3	6
		Objects The BDE handlested as a later of the state of the	665		-
	С	Obtain The PDE by eliminating φ and ψ from the relation	CO5	L3	6
		$z = x \varphi(y) + y \psi(x)$	665		-
	d	Solve $\frac{\partial^2 z}{\partial x \partial y} = sinxsiny$ given that $\frac{\partial z}{\partial y} = -2 siny$ when x=0 &	CO5	L3	7
		$\partial x \partial y$ showing given and ∂y			
		$z=0$ when y is an odd multiple of $\frac{\pi}{2}$			
L	L	I			

b. Assignment -1

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

SNo l	USN		Assign	ment Des	cription		Mark	CO	Level
Note: Eacl	Note: Each student to answer 3 assignments. Each assignment carries equal mark.								
	Methods								
Course:	Advanced	Calculu	s and	Numerical					
	1								
Crs Code:	18MAT2	Sem:	II	Marks:	10	Time:			
	Model Assignment Questions								
note: A di	stinct assi	gnment to	be assigne	ed to each s	tuaent.				

		S		
1	Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$	5	CO.3	L3
2	Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$	5	CO.3	L3
3	Solve $6y'' + 17y' + 12y = e^{-x}$	5	CO.3	L3
4	Solve $y'' - 4y' + 13y = Cos2x$	5	CO.3	L3
5		5	CO.4	L3
6	Solve $y'' + 2y' + 5y = e^{-x}Sin2x$. Solve $y'' - 2y' + y = xe^{x}Sinx$.	5	CO.4	L3
7	Solve the equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 25y = e^{2x} + Sinx + x$	5	CO.4	L3
8	Solve the equation at $\frac{d^3y}{dx^3} + y = Cos(\frac{\pi}{2} - x) + e^x$	5	CO.4	L3
9	Solve $\frac{d^2x}{dt^2}$ + $4\frac{dx}{dt}$ + 29 x = 0. Find y when x(0)=0 and $\frac{dx}{dt}$ (0)=15	5	CO4	L3
10	Solve $(D^3+D^2-4D-4)y=3e^{-x}-4x-6$	5	CO3	L3
11	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$ Solve $x^2y'' + 5xy' + 13y = logx + x^2$	5	CO4	L3
12	Solve $x^2y'' + 5xy' + 13y = logx + x^2$	5	CO3	L3
13	Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$	5	CO3	L3
14	Solve by the method of variation of parameters $y'' - y = \frac{2}{1 + e^x}$ Solve $(D^4 + 8D^2 + 16)y = 2\cos^2 x$	5	CO4	L3
15	Solve $(D^4 + 8D^2 + 16)y = 2\cos^2 x$	5	CO3	L3
	Solve $(3x+2)^2 y'' + 3(3x+2) y' - 36 y = 8x^2 + 4x + 1$	5	CO3	L3
3	$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 10y + 37\sin 3x = 0.$ Find y	5	CO3	L3
16	Obtain the PDE by eliminating the arbitrary function $z=f(x+at)+g(x-at)$	5	CO5	L3
17	Form a PDE by eliminating arbitrary constants $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	5	CO5	L3
18	Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$ subject to the conditions $\frac{\partial z}{\partial x} = logx$ when y=1 and z=0 at x=1.	5	CO5	L3
19	Solve $(D^3 + 3D^2)x = 1 + t$	5	CO3	L3

20	Obtain the PDE of the function $\varphi(xy+z^2,x+y+z)=0$	5	CO5	L3
21	Obtain The PDE by eliminating $ \varphi $ and $ \psi $ from the relation $z = x \varphi(y) + y \psi(x)$	5	CO5	L3
22	Solve $\frac{\partial^2 z}{\partial x \partial y} = sinxsiny$ given that $\frac{\partial z}{\partial y} = -2 siny$ when x=0 & z=0 when y is an odd multiple of $\frac{\pi}{2}$	5	CO5	L3

D2. TEACHING PLAN - 2

Title:	Partial differential equations	Appr	12 Hrs
		Time:	
a	Course Outcomes	СО	Bloom
			<u> </u>
-	The student should be able to:	-	Level
1	Construct a variety of partial differential equations and solution by exact methods/method of separation of variables	CO.5	L3
b	Course Schedule		
Class No	Portion covered per hour	-	-
1	Formation of PDE's by elimination of arbitrary constants	CO.5	L3
2	Formation of PDE's by elimination of arbitrary functions	CO.5	L3
3	Solution of non-homogeneous PDE by direct integration	CO.5	L3
4	Homogeneous PDEs involving derivative with respect to one independent variable only	CO.5	L3
5	Solution of Lagrange's linear PDE.	CO.5	L3
6	Derivative of one dimensional heat equations	CO.6	L3
7	Derivative of one dimensional wave equations	CO.6	L3
8	solutions by the method of separation of variables.	CO.6	L3
С	Application Areas	-	-
3	It is used to describe a wide variety of phenomena such as sound, heat and diffusion.		L3
3	It is used to describe a wide variety of phenomena such as	CO.6	L3
	electrostatics, electrodynamics and quantum mechanics.		
d	Review Questions	-	-
-		-	-
1	Solve by eliminating arbitrary constants	CO.5	L3
	a) $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$		
	b). $(x - a)^2 + (y - b)^2 = z^2 Cot^2 \alpha$		
2	Solve by eliminating arbitrary functions 1.	CO.5	L3
	$z = y^2 + 2f \begin{bmatrix} \frac{1}{x} + \log y \end{bmatrix} \begin{bmatrix} \frac{1}{x} + \log y \end{bmatrix} z \cdot z = yf(x) + x\varphi(y)$		
3	Find the solution of the heat equation by the method of separation of variables.	CO.6	L3
4	Find the solution of the wave equation by the method of separation of variables.	CO.6	L3
5	Derive D'Alemberts solution of the wave equation.	CO.6	L3
	1		

6	A tightly stretched string with fixed end points at $x=0$, $x=l$ is	CO.6	L3
	initially in a position $y = a \sin^3 \left\{ \frac{\Pi x}{l} \right\}$ and released from rest. Find		
	the displacement $y(x,t)$ at any time t		
7	A string is stretched and fastened to two points I apart. Motion	CO.6	L3
	is started by displacing the string in the form $y = a \sin \left\ \frac{\Pi x}{l} \right\ $		
	from which it is released at time $t=0$. show that the		
	displacement of any point at a distance x from one and at time t		
	is given by $y(x,t) = a \sin \left\ \frac{\Pi x}{l} \right\ \cos \left\ \frac{\Pi ct}{l} \right\ $		
8	Derive one dimentional Heat equation.	CO.6	L3
9	Derive one dimensional wave equation. Find the solution of two - dimentional Laplace equation by the method of separation of variables.	CO.6	L3
10	Find the solution of two - dimentional Laplace equation by the method of separation of variables.	CO.6	L3
11	An insulated rod of length $\it I$ has its end Aand B maintained at		L3
	$0^{ m o}$ c and $100^{ m o}$ c respectively until steady state condition		
	prevail. If B is suddenly reduce to $ { m O}^{ 0} { m c} $ and maintained at $ { m O}^{ 0} $		
	c .find the temperature at a distance x from A at time 't',		
12	Solve by direct integration $\frac{\partial z}{\partial y} = -2Siny$	CO.5	L3
13	Solve by direct integration $\frac{\partial^2 z}{\partial x^2} + 4z = 0$	CO.5	L3
1.4	-	COF	1.2
14	Solve by direct integration $\frac{\partial^3 z}{\partial x^2 \partial y} = Cos(2x + 3y)$	CO.5	L3

Title:	Infinite series and Power series solutions	Appr	13 Hrs
		Time:	
а	Course Outcomes	СО	Bloom
			S
-	The student should be able to:	-	Level
1	Explain the applications of infinite series and obtain series solution of ordinary differential equation	CO.7	L3
b	Course Schedule		
Class	Portion covered per hour	-	-
No			
1	Series of positive terms-convergence and divergence.	CO.7	L3
2	Cauchy's root test	CO.7	L3
3	D'Alembert's ratio test(without proof)-illustrative examples.	CO.7	L3
4	Series solution of Bessel's differential equation	CO.8	L3
5	Bessel's function of first kind-orthogonality	CO.8	L3
6	Series solution of Legendre differential equation	CO.8	L3
7	Legendre polynomial	CO.8	L3
8	Rodrigue's formula	CO.8	L3
С	Application Areas	-	-
4	It is used for analysis of current flow and sound waves in electric circuits.	7	L3
4	It is used in nuclear engineering analysis.	8	L3
d	Review Questions	-	-

1	$\sum_{n=1}^{\infty} n^n v^n$	CO7	L3
	Test the convergence of $\sum_{n=1}^{\infty} \frac{n^n x^n}{(n+1)^n}$, x>0		
2	Obtain the range of convergence of the series $2 \times 2^2 \times 2^3 \times 3^3 \times 5^4 \times 4^4$	CO7	L3
	$\frac{2x}{1^2} + \frac{3^2x^2}{2^3} + \frac{4^3x^3}{3^4} + \frac{5^4x^4}{4^5} + \dots; x > 0$		
3		CO7	L3
	Test for convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$		
4	Test for convergence or divergence of the series	CO7	L3
	$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \dots, x > 0$		
5	Test the convergence of the series: $\frac{2^2}{2^2} = \frac{2^2}{4^2} = \frac{4^2}{4^2}$	CO7	L3
	$1 + \frac{2^2}{2!} + \frac{3^2}{3!} + \frac{4^2}{4!} + \dots$		
6	Test the convergence of the series: $\begin{bmatrix} 2^2 & 2 \end{bmatrix}^{-1} \begin{bmatrix} 2^3 & 2 \end{bmatrix}^{-2} \begin{bmatrix} 4^4 & 4 \end{bmatrix}^{-3}$	CO7	L3
	$\left[\frac{2^2}{1^2} - \frac{2}{1} \right]^{-1} + \left[\frac{3^3}{2^3} - \frac{3}{2} \right]^{-2} + \left[\frac{4^4}{3^4} - \frac{4}{3} \right]^{-3} + \dots$		
7		CO7	L3
	Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$		
8	Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$	CO.8	L3
9	Express $f(x)=x^4+3x^3-x^2+5x-2$ in terms of legendres polynomials.	CO.8	L3
10	Express the following polynomials in terms of legendres polynomials $(x+1)(x+2)(x+3)$	CO.8	L3
11	If $lpha$ and eta are the roots of $J_n(x){=}0$ then	CO.8	L3
	$\int_{0}^{1} x J_{n}(\alpha x) J_{n}(\beta x) dx = 0; if \alpha \neq \beta$		
12	Using Rodrigues formula, obtain the expressions for $P_2(\cos\theta)$, $P_3(\cos\theta)$	CO8	L3
13	Use Rodrigue's formula to find $P_n(x)$ for n=0,1,2,3,4	CO.8	L3
14	If $x^3+2x^2-x+1=aP_0(x)+bP_1(x)+cP_2(x)+dP_3(x)$. Find the values of	CO.8	L3
	a,b,c,d		
15	Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$	CO.8	L3
	$\sum_{n=1}^{n+1} n^{n+1}$		
16	Prove that $I_{(y)} = \frac{2}{2}$	CO.8	L3
	Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x} \cos x}$	00.0	
17	Derive series solution of Bessels DE leading to Bessel functions.	CO.8	L3

Title:	Numerical Methods	Appr	13 Hrs
		Time:	
a	Course Outcomes	СО	Bloom
			S
-	The student should be able to:	-	Level

COURSE PLAN - CAY 2018-19

		applications ferential equ						-		L.
b	Course Sci	hedule								
lass	Portion co	vered per h	our						-	-
No 1	Finite difere	nces							CO.9	L3
2		rward and ba	ckward	difference	- forr	mula			CO.9	L3
3		vdede differe			1011	Tidia			CO.9	
4	Lagranges f		iice ioii	IIuia					CO.9	L3
5	Newton rap								CO.9	L3
6	Regula falsi								CO.9	L
7		ntegrations,							CO.1 0	L:
8		impsons 1/3 rd rule problems								L.
9		mpsons 3/8 th rule problems								
10	Weddles ru	le and proble	ms						CO.1 0	L3
С	Applicatio	n Areas							_	
5		work simulat	ion and	weather i	oredi	ction			9	L.
5	Used in confinding.	nputer scien	ce for ro	ot algorit	hm a	and m	ultidimer	nsional root		L
d	Review Qu	estions							-	-
1	From the following table find the number of students who have obtained less than 45								CO.9	L.
	Marks	30-40	40-50			50-70	70-80			
	No. of students	31	42	51	3	85	31			
2	Using Lagra	anges formu	la find t	he value	of y	at x=	6 by the	e following	CO.9	L.
	x	0		L		2		5		
		2		3		12		147	_	
3	y 5.2					12		147	CO.1	L.
3		dx using	weddle	s rule tak	ing t	he ste	p size o	f 0.2	0	L,
4	Evaluate j	$\int_{0}^{1} \left(\frac{x}{1+x^{2}}\right) dx$	y using	simpson	's (1,	/3) rd	rule divi	ding the	CO.1 0	L
	interval into $\log \sqrt{2}$	interval into 6 equal parts.Hence find an approximate value of $\log\sqrt{2}$								
5	_	Newtons Rap 3x=cosx+1	hson m	ethod fin	d the	e real	root of t	he	CO.1 0	L
6	Using Regular $x \log_{10} x = 1$.	ıla-falsi meth 2	nod find	the real	root	of the	equatio	on	CO.1 0	L
7	The area of below.	f a circle (A)	corresp	onding to	the	diam	eter (D)	is given	CO.1 0	L.
	DCIOW.								0	

	Α	5026	5674	6362	7088	7854		
	Find the are interpolation		nding to dia	meter 105	using an ap	propriate		
7	Evaluate	$\int_{0}^{0.3} \sqrt{1 - 8 x^3} dx$	_x by using	g simpson's	(3/8) th rule	e by taking	CO.1 0	L3
	7 ordinates							
	Using the Nequation 3		hson metho	od find the I	real root of	the	CO.1 0	L3

E2. CIA EXAM - 2

a. Model Question Paper - 2

	d Calculus nswer all	s and Nu		MAT21 Sem: II Marks: 50 Tim									
		s anu nu	l Mothodo										
: 3, 4						arks. Mod	dule	СО	Level	Mark s			
1 a If $\vec{F} = \nabla$	$(x v^3 z^2) F$	ind div	\vec{F} and	$\operatorname{curl} \vec{F}$ at	the point	(1, -1, 1)		CO.1	L3	6			
	angle be							CO.1	L3	6			
	2 -3 at (2		ine san		y 12 = 3	ana							
c Find the	direction	al deriv	ative o	$f \varphi = x^2 y^2$	$z+4xz^2$ at	t(1, -2, -1)	in	CO.2	L3	6			
d Show th	at $\vec{F} = (y + $	-z)i+(z-	+x)j+(x)	(x+y)k is	irrotation	al. Also fin	d a	CO.2	L3	7			
scalar f	inction 9	such t	hat \vec{F}	$=\nabla \varphi$									
			C)R									
	work dor $+(2xz-y)$		_	-		ce field n (0,0,0) to	,	CO.1	L3	6			
b Use the across t		, S is th	ie recta	ngular pa	rallelopip	Find the ped bounder $j + xzk$		CO.1	L3	6			
is the b	oundary ir	n the re	င် ctangle	0≤ <i>x</i> ≤	≤π ,0≤ <i>y</i> ≤	·	e C	CO.2	L3	6			
where o	Greens to 0 , $x=\pi/2$,	angle in	the xy-	C		+cosxdy) the lines		CO.2	L3	7			
	e followin d less tha	_	find the	e number	of stude	nts who ha	ive	CO.9	L3	6			
Marks	30	0-40	40-50	50-60	60-70	70-80							

		No. of students	31	42	51	35	31				
	b	Using Lagr following to		nula find t	the value	of y at x	c=6 by th	e	CO.9	L3	6
		x	0		l	2		5			
		У	2		3	12		147			
	С	Find $\int_{4}^{5.2} (\log x)^{-5.2}$	gx)dx usin	g weddle	s rule tak	ing the s	tep size o	f 0.2	CO.1 0	L3	6
	d	Evaluate the interval of $\log \sqrt{2}$, 1.7						CO.1 0	L3	7
					OR						
4	а	Using the Nequation		-	ethod fin	d the rea	al root of t	he	CO.9	L3	6
	b	Using Regular $x \log_{10} x = 1$.		ethod find	the real	root of th	ne equatio	on	CO.9	L3	6
	С	The area o		A) corresp	onding to	the dia	meter (D)	is		L3	6
		D	80	85	90	95	100)	CO.9		
		Α	5026	5674	6362	7088	785	4			
		Find the ar appropriate				r 105 usi	ng an				
	d	Evaluate taking 7 o	0	d _x by u	sing simp	oson's (3	/8) th rule	by	10	L3	7

b. Assignment - 2

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

	tote. At distinct assignment to be assigned to each stadent.									
				Model A	Assignment	Questions				
Crs C	ode:	18MAT	2Sem:	П	Marks:	10				
		1								
Cour	se:	Advance	d Calculus a	nd Numeri	ical	Module: 3,	. 4			
		Methods								
Note	: Eacl	h student	to answer 2	2-3 assignr	nents. Eacl	n assignme	nt carries eq	ual ma	rk.	
SNo	SNo USN Assignment Description								СО	Level
								S		
1					$\sum_{n=0}^{\infty} n^n x^n$			5	CO7	L3
			Test the conv	ergence of	$\sum \frac{n}{(n-1)!}$,x>0				
Test the convergence of $\sum_{n=1}^{\infty} \frac{n^n x^n}{(n+1)^n}$, x>0										
2			obtain the rai	inge of contr	cryclice or c	ic scries		5	CO7	L3
			$2x \cdot 3^2 x^2$	$4^3 x^3 \cdot 5^4$	χ^4	. 0				
			$\frac{1^2}{1^2} + \frac{1}{2^3}$	++-	$\frac{x^4}{5}$ +;	x>0				
			1 2	S 4						

Test for convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$ 5 CO7 L3 Test for convergence or divergence of the series $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^2}{4\sqrt{3}} + \dots + x > 0$ Test the convergence of the series: $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^2}{4\sqrt{3}} + \dots + x > 0$ Test the convergence of the series: $\frac{1}{2} + \frac{2^2}{2!} + \frac{3^2}{3!} + \frac{4^2}{4!} + \dots + x > 0$ Test the convergence of the series: $\frac{1}{2^2} - \frac{2}{1} = \frac{1}{2} + \frac{3^2}{2^3} + \frac{3}{2} = \frac{1}{2} + \frac{4^3}{4} + \frac{4}{3} = \frac{3}{4} + \dots + \frac{1}{2} = \frac{1}{2} + \frac{1}{2} + \frac{3^2}{2^3} + \frac{3}{2^3} = \frac{1}{2} + \frac{4^3}{4} + \frac{4}{3} = \frac{3}{4} + \dots + \frac{1}{2} = \frac{1}{2} + \frac{1}{2} + \frac{3^2}{2^3} + \frac{3}{2^3} = \frac{1}{2} + \frac{1}{2} + \frac{3^3}{4} + \frac{4}{3} = \frac{1}{2} + \frac{1}{2}$		22.00-1-2.00-00-00-00-00-00-00-00-00-00-00-00-00-			
$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \dots, x>0$ Fest the convergence of the series: $1 + \frac{2^2}{2!} + \frac{3^2}{3!} + \frac{4^2}{4!} + \dots$ Test the convergence of the series: $\left[\frac{2}{1^2} - \frac{2}{1}\right]^{-1} + \left[\frac{3^2}{2^2} - \frac{3}{2}\right]^{-2} + \left[\frac{4^4}{3^4} - \frac{4}{3}\right]^{-3} + \dots$ Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ 5 CO7 L3 Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ 5 CO8 L3 Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ 9 Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of legendres polynomials. 10 Express the following polynomials in terms of legendres polynomials (x+1)(x+2)(x+3) 11 If α and β are the roots of $J_n(x) = 0$ then $J_n(x$	3	Test for convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$	5	CO7	L3
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	4		5	CO7	L3
	5	$1 + \frac{2^2}{2!} + \frac{3^2}{3!} + \frac{4^2}{4!} + \dots$	5	CO7	L3
Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x}{n^{n+1}}$ Solution in the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Solution is less than the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Solution is less than the series Solution of Bessels DE leading to Bessel Solution Solution is less than the series Solution of Bessels DE leading to Bessel Solution Solution is less than the series Solution of Bessels DE leading to Bessel Solution Solution Solution is less than the series Solution of Bessels DE leading to Bessel Solution Sol	6		5	CO7	L3
Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of legendres polynomials. 10 Express the following polynomials in terms of legendres polynomials $(x+1)(x+2)(x+3)$ 11 If α and β are the roots of $J_n(x) = 0$ then 12 Using Rodrigues formula, obtain the expressions for $P_2(\cos\theta), P_3(\cos\theta)$ 13 Use Rodrigue's formula to find $P_n(x)$ for $n=0,1,2,3,4$ 14 If $x^3 + 2x^2 - x + 1 = aP_0(x) + bP_1(x) + cP_2(x) + dP_3(x)$. Find the values of a,b,c,d 15 Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ 5 CO.8 L3 16 Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$ 5 Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3		Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$			L3
polynomials. Express the following polynomials in terms of legendres polynomials $(x+1)(x+2)(x+3)$ If α and β are the roots of $J_n(x)=0$ then $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0; if \alpha \neq \beta$ Using Rodrigues formula, obtain the expressions for $P_2(\cos\theta), P_3(\cos\theta)$ Use Rodrigue's formula to find $P_n(x)$ for $n=0,1,2,3,4$ If $x^3+2x^2-x+1=aP_0(x)+bP_1(x)+cP_2(x)+dP_3(x)$. Find the values of a,b,c,d Let us discuss the convergence of the series $\sum_{n=1}^\infty \frac{(n+1)^n x^n}{n^{n+1}}$ Four that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} cosx$ Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	8		5	CO.8	L3
polynomials $(x+1)(x+2)(x+3)$ If α and β are the roots of $J_n(x)=0$ then $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0; if \alpha \neq \beta$ 12 Using Rodrigues formula, obtain the expressions for $P_2(\cos\theta), P_3(\cos\theta)$ 13 Use Rodrigue's formula to find $P_n(x)$ for n=0,1,2,3,4 14 If $x^3+2x^2-x+1=aP_0(x)+bP_1(x)+cP_2(x)+dP_3(x)$. Find the values of a,b,c,d 15 Let us discuss the convergence of the series $\sum_{n=1}^\infty \frac{(n+1)^n x^n}{n^{n+1}}$ 5 CO.8 L3 16 Prove that $J_{-1/2}(x)=\sqrt{\frac{2}{\pi x}} cosx$ 17 Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	9	polynomials.		CO.8	L3
If α and β are the roots of $J_n(x)=0$ then $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$; if $\alpha \neq \beta$ 12 Using Rodrigues formula, obtain the expressions for $P_2(\cos\theta), P_3(\cos\theta)$ 13 Use Rodrigue's formula to find $P_n(x)$ for $n=0,1,2,3,4$ 14 If $x^3+2x^2-x+1=aP_0(x)+bP_1(x)+cP_2(x)+dP_3(x)$. Find the values of a,b,c,d 15 Let us discuss the convergence of the series $\sum_{n=1}^\infty \frac{(n+1)^n x^n}{n^{n+1}}$ 5 CO.8 L3 16 Prove that $J_{-1/2}(x)=\sqrt{\frac{2}{\pi x}cosx}$ 5 Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3		polynomials $(x+1)(x+2)(x+3)$			
$P_{2}(\cos\theta), P_{3}(\cos\theta)$ Use Rodrigue's formula to find $P_{n}(x)$ for n=0,1,2,3,4 $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+1=aP_{0}(x)+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . \text{ Find the values of a,b,c,d}}$ $If x^{3}+2x^{2}-x+bP_{1}(x)+cP_{2}(x)+dP_{3}(x) . Find the values of$	11	If α and β are the roots of $J_n(x) = 0$ then	5	CO.8	L3
14 If $x^3+2x^2-x+1=aP_0(x)+bP_1(x)+cP_2(x)+dP_3(x)$. Find the values of a,b,c,d 15 Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ 5 CO.7 L3 Prove that $J_{-1/2}(x)=\sqrt{\frac{2}{\pi x}cosx}$ 5 CO.8 L3 Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	12		5	CO.8	L3
the values of a,b,c,d Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$ Frove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x} cosx}$ Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	13	Use Rodrigue's formula to find $P_n(x)$ for n=0,1,2,3,4	5	CO.8	L3
16 Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} cosx$ 5 CO.8 L3 17 Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	14		5	CO.8	L3
Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$ Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	15	Let us discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n x^n}{n^{n+1}}$		CO.7	L3
Derive series solution of Bessels DE leading to Bessel 5 CO.8 L3	16	Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$	5	CO.8	L3
	17	Derive series solution of Bessels DE leading to Bessel	5	CO.8	L3

F. EXAM PREPARATION

1. University Model Question Paper

Cours		Advanced calculus and Numerical methods Month /	/ Year	May /2	2018
		18MAT21 Sem: II Marks: 100 Time:		180	
				minut	
Mod ule	Not e	Answer all FIVE full questions. All questions carry equal marks.	Mark s	СО	Leve I
1		If $\vec{F} = \nabla(x y^3 z^2)$ Find div \vec{F} and curl \vec{F} at the point (1, -1, 1)	6	CO.1	L3
		Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and	7	CO.1	L3
		$z=x^2+y^2-3$ at (2,-1,2)			
	С	Evaluate by Stokes theorem $\oint_c (sinzdx - cosxdy + sinydz)$ where c is	7	CO.2	L3
		the boundary in the rectangle $0 \le x \le \pi, 0 \le y \le 1, z=3$			
		OR			
2		Find the work done in moving a particle in the force field $\vec{F} = 3x^2i + (2xz - y)j + zk$ along the straight line from (0,0,0) to (2,1,3)	6	CO.1	L3
		Use the divergence theorem to evaluate $\iint\limits_{S} \vec{F} \cdot \hat{n} ds$. Find the flux	7	CO.2	L3
		across the suface, S is the rectangular parallelopiped bounded by $x=0,y=0,z=0,x=2,y=1,z=3$ where $\vec{F}=2xyi+yz^2j+xzk$			
		Find the directional derivative of $\varphi = x^2 yz + 4 x z^2$ at(1, -2, -1) in the direction of 2i-j-2k.	7	CO.1	L3
3	а	Solve $\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 29x = 0$. Find y when x(0)=0 and $\frac{dx}{dt}$ (0)=15	6	CO3	L3
	b	Solve $(D^3+D^2-4D-4)y=3e^{-x}-4x-6$	7	CO.3	L3
	С	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$	7	CO4	L3
		OR			
4	а	Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$	6	CO.3	L3
	h	Solve by the method of variation of parameters $y'' - y = \frac{2}{1 + e^x}$	7	CO.4	L3
	С	Solve $(D^4 + 8D^2 + 16) y = 2\cos^2 x$	7	CO.3	L3
5		Obtain the PDE by eliminating the arbitrary function $z=f(x+at)+g(x-at)$	6	CO.5	L3
	b	Form a PDE by eliminating arbitrary constants $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	7	CO5	L3

	С	$\partial^2 z$	X subject	+ + 0 +	-b o	condition	-	∂z_	امیر سام		7	CO.6	L3
		Solve $\frac{\partial^2 z}{\partial x \partial y} =$	0	τιοι	.ne	condition	15	${\partial x}$	logx wn	ien			
		y=1 and $z=0$	at $x=1$.										
						OR							
6	а	Obtain the PD	E of the fo	uncti	on	$\varphi(xy+z)$	² ,	x+y+	z)=0		6	CO.5	L3
	b	Obtain The PD $z = x \varphi(y)$	E by eliminary)+ $y \psi(x)$	inati	ng	$arphi$ and ψ	fr	om th	e relatio	on	7	CO6	L3
	С	$z = x \varphi(y)$ Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial x \partial y}$	sinxsiny (giver	tha	at $\frac{\partial z}{\partial y} = -$	-25	siny v	vhen x=	0 &	7	CO.6	L3
		z=0 when y i	s an odd r	nulti	ple	of $\frac{\pi}{2}$							
7	a		_α	n^n	\mathbf{y}^n						6	CO.7	L3
		Test the converg	11-	· T / 1	- /								
	b	Obtain the range	tain the range of convergence of the series $\frac{2x}{1^2} + \frac{3^2x^2}{2^3} + \frac{4^3x^3}{3^4} + \frac{5^4x^4}{4^5} + \dots; x > 0$										L3
		$\frac{2x}{1^2} + \frac{3x}{2^3} + \frac{4}{3}$	$\frac{x}{3^4} + \frac{5 x}{4^5} + \frac{5}{4^5}$; x	>0							
	С	Prove that I	$(\mathbf{y}) = \sqrt{\frac{2}{\mathbf{z}}}$	cinv							7	CO.8	L3
		J 1/2	rove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} sinx$										
												20.7	
8	а	Test for converge	ence or dive	rgenc	e of	the series	n:	$\sum_{n=1}^{\infty} \frac{n!}{(n^n)}$	2		6	CO.7	L3
	b	Test for converge	ence or dive	rgenc	e of	the series					7	CO.7	L3
		$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^2}{4\sqrt{2}}$	$\frac{x}{\sqrt{3}}$ +	, <i>x</i> > 0	0								
	С	If α and β	are the roo	ts of	\boldsymbol{J}_n	(x)=0 th	nen				7	CO.8	L3
		$\int_{0}^{1} x J_{n}(\alpha x) J_{n}(\alpha x)$	$(\beta x)dx = 0$; if α	≠β								
9	a	From the follow	ving table	find	the	number	of	stude	nts who	have	6	CO9	L3
3	u	obtained less t	_	mia		Trainiber !	0.	Stade	nes wno	nave			
		Marks	30-40	40-5	50	50-60	6	0-70	70-80				
		No. of students	31	42		51	3	5	31				
	b	Using Lagrang following table		find	the	value of	У	at x=	=6 by the		7	CO9	L3
		x	0		1			2		5			
		У	2		3			12		147			
	С	Find $\int_{4}^{5.2} (logx) dx$	_x using w	eddle	es r	ule taking	g t	he ste	ep size o	f 0.2	7	CO10	L3
		OR											
		•											

10	a	_	Newtons R 3x=cosx+	aphson me 1	thod find t	he real roo	t of the	6	CO9	L3
	b	Using Reg	ula-falsi me	ethod find t	the real roo	ot of the eq	uation	7	CO9	L3
		$x \log_{10} x = 1$	2							
	С	The area of given belo	of a circle (<i>i</i> ow.	r (D) is	7	C010	L3			
		D	80	85	90	95	100			
		Α	5026	5674	6362	7088	7854			
				onding to out on the control of the	<u>,</u>					

2. SEE Important Questions

Cours	se:	Advanced cal	culus and N		Month	/ Year	May /2	2018		
Crs C	ode:	18MAT21	Sem:	2	Marks:	100	Time:		180	
	Not	Angwar all EIV	/E full guest	ions Allaus	stions corn	agual mark		1	minut	es
	е	Answer all FI\	z iuli quest	ions. All que	Scions Carry	equal mark	.5.	-	-	
	Qno.	Important Qu	estion					Mark	СО	Year
ule 1	а	If $\vec{F} = \nabla (x y^3)$	3-2 Find div	√E and cur	dr at the p	oint /1 1	1 \	S	CO 1	2013
		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \					Ι)	7		2015
		Find the ang $z=x^2+y^2-3$	at (2,-1,2)		,		2015			
	С	Find the dire the direction	nd the directional derivative of $\varphi = x^2 yz + 4 x z^2$ at(1, -2, -1) is direction of 2i-j-2k.							
			,	OR						
2	а	Find the work $\vec{F} = 3x^2i + (2x^2)(2,1,3)$					to	6	CO1	2014
	b	across the su	Use the divergence theorem to evaluate $\iint_S \vec{F} \cdot \hat{n} ds$. Find the fluor across the suface, S is the rectangular parallelopiped bounded by $x=0,y=0,z=0,x=2,y=1,z=3$ where $\vec{F}=2xyi+yz^2j+xzk$					7	CO1	2016
	С	Evaluate by s		c	$dx - cosxdy + 0 \le x \le \pi , 0 \le x$		ere c	7	CO2	2017
3	а	Solve $\frac{d^2x}{dt^2}$ +4	$4\frac{dx}{dt} + 29x = 0$). Find y wh	en x(0)=0	and $\frac{dx}{dt}(0)$)=15	6	CO3	2013
		Solve $(D^3 + D^3)$						7	CO3	2013
	С	Solve by the $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9$	method of	f variation o		ers		7	CO4	2013
				OR						

4	а	12 1	6	CO3	2013
_	a	Solve $\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$	O		
	b	Solve by the method of variation of parameters $y'' - y = \frac{2}{1 + e^x}$	7	CO3	2012
	С	Solve $(D^4 + 8D^2 + 16) y = 2\cos^2 x$	7	CO4	2012
					2012
5	а	$\frac{d^{2}y}{dx^{2}} + 2\frac{dy}{dx} + 10y + 37\sin 3x = 0.$ Find y Solve $x^{2}y'' + 5xy' + 13y = logx + x^{2}$	6	C05	2010
	b	Solve $x^2y'' + 5xy' + 13y = logx + x^2$	7	CO5	2010
	С	Solve $(3x+2)^2 y'' + 3(3x+2) y' - 36 y = 8x^2 + 4x + 1$	7	CO6	2012
		OR			2012
6	а	Solve $x^2 y'' + 5xy' + 13 y = sinx + x^2$	6	CO5	
	b	Solve $(3x+2)^2 y'' + 3(3x+2) y' - 36 y = 8x^3 + 2x 2 sinx$	7	CO5	2012
	С	$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 10y + 37\sin 3x = 0.$ Find y	7	CO6	2013
7	а	Obtain the PDE by eliminating the arbitrary function $z=f(x+at)+g(x-at)$	6	C07	2010
	b	Form a PDE by eliminating arbitrary constants $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	7	CO7	2014
	С	Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$ subject to the conditions $\frac{\partial z}{\partial x} = logx$ when y=1 and z=0 at x=1.	7	CO8	2015
		OR			
7	а	Test the convergence of $\sum_{n=1}^{\infty} \frac{n^n x^n}{(n+1)^n}$, x>0	6	CO7	2006
	b	Obtain the range of convergence of the series $\frac{2x}{1^{2}} + \frac{3^{2}x^{2}}{2^{3}} + \frac{4^{3}x^{3}}{3^{4}} + \frac{5^{4}x^{4}}{4^{5}} + \dots; x > 0$	7	CO7	2008
	С	Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$	7	CO8	2016
		OR			
8	а	Test for convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$	6	CO7	2008
	b	Test for convergence or divergence of the series $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \dots, x > 0$	7	CO7	2006
	С	If $lpha$ and eta are the roots of $J_n(x) = 0$ then	7	CO8	2014

		$\int_{0}^{1} x J_{n}(\alpha x) J_{n}(\beta x) dx = 0; if \alpha \neq \beta$										
9	а	From the following table find the number of students who have obtained less than 45								6	CO9	2013
		Marks	30-40	40-5	50 !	50-60	60-70	70-80				
		No. of students	31	42	!	51	35	31				
	b	Using Lagr following t		nula find	l the v	value of	y at x	=6 by the	<u> </u>	7	CO10	2015
		Х	0		1		2		5			
		у	2		3		12		147			
	С	Find $\int\limits_{4}^{5.2} (logx) dx$ using weddles rule taking the step size of 0.2							7	CO10	2016	
					OR							
10	Using the Newtons Raphson method find the real root of the equation $3x = cosx + 1$						ne	6	CO9	2014		
	b	b Using Regula-falsi method find the real root of the equation $x \log_{10} x = 1.2$						7	CO9	2016		
	С	The area of a circle (A) corresponding to the diameter (D) is given below.							7	C010	2015	
	D 80 85 90 95 100											
	A 5026 5674 6362 7088 7854								4	1		
	Find the area corresponding to diameter 105 using an appropriate interpolation formula.											

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA - Example Course

Мо	,	Conten	Blooms'	Final	Identifie	Instructi	Assessmen
du	(Split module content into 2 parts which	t	Learnin	Bloo	d Action	on	t Methods
e-	have similar concepts)	Teachin	g	ms'	Verbs	Method	to Measure
#		g Hours	Levels	Leve	for	s for	Learning
			for		Learning	Learnin	
			Content			g	
A	В	С	D	Ε	F	G	Н
1	Scalar and Vector fields, Gradient,	4		L3	-	-	- Slip Test
	directional derivative, curl and		- L3		-	Lecture	-
	divergence-physical interpretation:				underst	-	-
	solenoidal and irrotational vector fields-				and	_	
	illustrative problems.						
1	Line Integrals, Theorems of Green, Gauss	6	- L3	L3	-analyze	_	-
	and Stokes(without proof). Applications to				-	Lecture	Assignmen
	work done by force and flux.					_	t
						Tutorial	-
						-	-
2	Second order Linear ODE's with constant	4	- L3	L3	-apply	-	-

	coefficients-Inverse differential operators, method of variation of parameters.		- L3		-	Lecture -	Assignmen t
2	Cauchy's and Legendre homogeneous equations. Applications to oscillations of a spring and L-C-R circuits.	6	- L3	L3	-apply -	- Lecture -	- Slip Test -
	Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables.		- L3	L3	- underst and -	- Lecture -	- Slip Test -
3	Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables.		- L3	L3	apply	- Lecture - Tutorial -	- Assignmen t - -
4	Series of positive terms-convergence and divergence. Cauchy's root test and D'Alembert's ratio test(without proof)-illustrative examples.	5	- L3	L3	analyze	- Lecture - Tutorial -	- Assignmen t - -
4	Series solution of Bessel's differential equation leading to Jn(x)-Bessel's function of first kind-orthogonality. Series solution of Legendre polynomials. Rodrigue's formula(without proof),problems.		- L3	L3	apply	- Lecture - Tutorial -	- Assignmen t - -
5	Finite differences, Interpolation/extrapolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae(All formulae without proof).	5	- L3	L3	-analyze	Lecture - -	- Assignmen t - -
5	Solution of polynomial and transcendental equations- Newton-Raphson and Regula-Falsi methods(only formulae)-illustrative examples. Simpson's (1/3) rd and (3/8) th rules, Weddle's rule(without proof)-Problems.		L3	L3	apply	Lecture	Assignmen t
-	Total			-			

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 /	4.Benchmark)	
				Syllabus. A short		
				word for learning		
				or outcome)		
Α	1	J	K	L	М	N

	Vector fields, Gradient, directional derivative,c url and divergence- physical interpretatio n: solenoidal and irrotational vector fields- illustrative problems.	differenti ation	Vector Differentia tion	applications of multivariate calculus to understand the solenoidal irrotational vectors.		Illustrate Vector Differentiation
	Integrals, Theorems of Green, Gauss and Stokes(with out proof). Applications to work done by force and flux.	on	Vector Integration	Exhibit the interdependence of line, surface and volume integrals.		Integration
	order Linear ODE's with constant coefficients-Inverse differential operators, method of parameters.		Ordinary Differential equations	models through higher order differential equations and solve such linear.Ordinary differential equation.		Analyze Ordinary Differential equations
2	Cauchy's and Legendre homogeneo us equations. Applications to oscillations of a spring and L-C-R circuits.		Ordinary Differential equations	behaviour of LCR	equations	Analyze Ordinary Differential equations
	Formation of PDE's by elimination of arbitrary constants and functions.		Partial Differential equations	Construct a variety of partial differential equations.	Partial Differential equations	Analyze Partial Differential equations

3	non-homogeneo us PDE by direct integration. Homogeneo us PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables. Derivative of one dimensional heat and wave equations and solutions by the method of separation of variables.	Differential		Analyze Differential equations	Partial
	heat and wave equations and solutions by the method of separation of variables.	i i	of separation of variables.	equations	
4	Series of positive terms-convergence and divergence. Cauchy's root test and D'Alembert's ratio test(without proof)-illustrative examples.	series	To explain the applications of infinite series.	Undrstand series	Infinite
4	Series solution of Bessel's differential equation		To obtain series solution Of Ordinary differential equation.	Analyze series	Power

	leading to Jn(x)- Bessel's function of first kind- orthogonalit y. Series solution of Legendre polynomials. Rodrigue's formula(with out proof),problems.				
5	Finite differences, Interpolation /extrapolatio n using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae(All formulae without proof).			methods	Analyze Numerical methods
5	Solution of polynomial and transcenden tal equations-Newton-Raphson and Regula-Falsi methods(only formulae)-illustrative examples. Si mpson's (1/3)rd and (3/8)th rules, Weddle's rule(without proof)-Problems.	methods	Numerical integration comprises a broad of algorithms for calculating the numerical value of definite integral.		Analyze Numerical methods