ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMMES

Bachelor of Science

(B.Sc. Mathematics)

Three Years

Learning Outcomes based Curriculum Framework(LOCF)

Academic Year

2020 - 2021

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

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Kattankulathur-603203, Chengalpattu District, Tamil Nadu, India

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1.	Department Vision Statement
Stmt - 1	*To impart education and disseminate knowledge with high standards in Mathematics, Engineering and Technology in our academic pursuit.*
Stmt - 2	*To emerge as a world class hub of research that creates a center of excellence in mathematics.*
Stmt – 3	*To develop mathematical thinking and applying it to solve problems, designing mathematical modeling for systems involving global level technology.*

2.	Department Mission Statement
Stmt – 1	*To upgrade the student's knowledge to meet the academic changes.*
Stmt – 2	*To equip the students with the necessary mathematical tools to meet the competitive global environment.*
Stmt – 3	*To provide an environment where students can learn and become competent users of mathematics and its applications.*
Stmt – 4	*To enable students pursue more advanced study in pure mathematics, applied mathematics and related areas.*
Stmt – 5	*Developing the students for professional careers in disciplines which make use of the mathematical sciences.*

3.	Program Educational Objectives (PEO)
PEO - 1	*Acquire knowledge, Skill, Aptitude and Analytical ability.*
PEO - 2	*Creates mathematical models.*
PEO - 3	*Develops the skill to think critically on abstract concepts of mathematics.*
PEO - 4	*Formulate and develop mathematical arguments in a logical manner.*
PEO - 5	*Acquire domain knowledge to pursue higher education and research.*

4.	Program Specific Outcomes (PSO)
PSO - 1	*Graduates will acquire good knowledge and understanding in advanced areas of mathematics and statistics.*
PSO - 2	*Graduates will develop and formulate mathematical arguments in a logical manner.*
PSO - 3	*Graduates will be able to use the facility with mathematical and computational modeling of real decision making.*

5. Consistency of PEO's with Mission of the Department

	Mission Stmt. – 1	Mission Stmt. – 2	Mission Stmt. – 3	Mission Stmt. - 4	Mission Stmt. – 5
PEO – 1	H	M	H	L	M
PEO – 2	H	H	H	M	M
PEO – 3	H	M	H	H	H
PEO – 4	H	L	H	M	H
PEO - 5	H	H	M	H	M

H – High Correlation, M – Medium Correlation, L – Low Correlation

6. Consistency of PEO's with Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	1. Fundamental Knowledge	2. Application of Concepts	3. Link with Related Disciplines	4. Procedural Knowledge	5. Skills in Specialization	6. Ability to Utilize Knowledge	7. Skills in Modeling	8. Analyze, Interpret Data	9. Investigative Skills	10. Problem Solving Skills	11. Communication Skills	12. Analytical Skills	13. ICT Skills	14. Professional Behavior	15. Life Long Learning
PEO – 1	H	H	H	H	H	H	H	H	M	H	H	H	H	H	H
PEO – 2	H	M	H	H	H	H	H	H	H	H	L	H	H	H	H
PEO – 3	H	H	H	L	H	H	H	H	H	H	H	M	H	H	H
PEO – 4	H	H	H	H	H	M	H	H	H	H	H	H	L	H	H
PEO - 5	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H

7. Programme Structure

1. Professional Core Courses (C)
(12 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UMA20101T	Algebra and Trigonometry	5	1	0	6
UMA20102T	Analytical Geometry	5	1	0	6
UMA20103T	Numerical Analysis	5	1	0	6
UMA20201T	Differential Equations and Laplace Transforms	5	1	0	6
UMA20202T	Calculus	5	1	0	6
UMA20203T	Vector calculus, Fourier series and Transforms	5	1	0	6
UMA20301T	Probability and Statistics	5	1	0	6
UMA20401T	Discrete Mathematics	5	1	0	6
UMA20501T	Algebraic Structures	5	1	0	6
UMA20502T	Real Analysis	5	1	0	6
UMA20601T	Complex Analysis	5	1	0	6
UMA20602T	Mechanics	5	1	0	6
Total Learning Credits					**72**

2. Discipline Specific Elective Courses (E)
(4 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UMA20D01T	Number Theory	5	1	0	6
UMA20D02T	Operations Research				
UMA20D03T	Combinatorics				
UMA20D04T	Fuzzy Mathematics	5	1	0	6
UMA20D05T	Introduction to Partial Differential Equations				
UMA20D06T	Astronomy				
UMA20D07T	Graph Theory	5	1	0	6
UMA20D08T	Sequence and Series				
UMA20D09T	Linear Algebra				
UMA20D10L	Project Work	0	0	12	6
Total Learning Credits					**24**

4. Skill Enhancement Courses (S)
(6 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UMA20S01L	C Programming	0	0	4	2
UMA20S02L	Java Programming				
UMA20S03L	Scientific Documentation and Statistical Tools	0	0	4	2
UMA20S04L	PYTHON Programming				
UMA20S05L	Mathematical Software MATLAB	0	0	4	2
UMA20S06L	Mathematical Software SCILAB				
UMI20S01L	My India Project	0	0	0	1
UCD20S01L	Soft Skills	0	0	2	1
UCD20S02L	Quantitative Aptitude and Reasoning	0	0	2	1
Total Learning Credits					**9**

3. Generic Elective Courses (G)
(4 Courses))

Course Code	Course Title	Hours/ Week L	T	P	C
ULT20G01J	Tamil-I	2	0	2	3
ULH20G01J	Hindi-I				
ULF20G01J	French-I				
ULT20G02J	Tamil-II	2	0	2	3
ULH20G02J	Hindi-II				
ULF20G02J	French-II				
UPY20A01J	Allied Physics	4	0	4	6
UCY20A03J	Allied Chemistry	4	0	4	6
Total Learning Credits					**18**

6. Jeevan Kaushal(JK)
(4 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UJK20201L	Communication Skills	0	0	4	2
UJK20301T	Universal Human Values	2	0	0	2
UJK20401T	Professional skills	2	0	0	2
UJK20501T	Leadership and Management skills	2	0	0	2
Total Learning Credits					**8**

5. Ability Enhancement Courses (A)
(2 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
ULE20AE1T	English	4	0	0	4
UES20AE1T	Environmental Studies	3	0	0	3
Total Learning Credits					**7**

7. Extension activity (NS/NC/NO/YG)
(1 Course)

Course Code	Course Title	Hours/ Week L	T	P	C
UNS20201L	NSS	0	0	0	0
UNC20201L	NCC				
UNO20201L	NSO				
UYG20201L	YOGA				
Total Learning Credits					**0**

AS SRMIST STRONGLY ENCOURAGES THE USE OF SWAYAM (Study Web of Active Learning by Learning by Young and Aspiring Minds) PLATFORM, THE STUDENTS ARE ENCOURAGED TO CHOOSE ATLEAST ONE CORE/ ELECTIVE COURSE FROM SWAYAM ON THE RECOMMENDATION OF THE FACULTY ADVISOR AND THE CREDITS WILL BE TRANSFERRED

8. Implementation Plan

Semester – I

Code	Course Title	Hours/ Week L	T	P	C
ULT20G01J	Tamil-I	2	0	2	3
ULH20G01J	Hindi-I				
ULF20G01J	French-I				
ULE20AE1T	English	4	0	0	4
UMA20101T	Algebra and Trigonometry	5	1	0	6
UMA20102T	Analytical Geometry	5	1	0	6
UMA20103T	Numerical Analysis	5	1	0	6
UCD20S01L	Soft Skills	0	0	2	1
Total Learning Credits					26
Total number of hours /week					30

Semester – II

Code	Course Title	Hours/ Week L	T	P	C
ULT20G02J	Tamil-II	2	0	2	3
ULH20G02J	Hindi-II				
ULF20G02J	French-II				
UMA20201T	Differential Equations and Laplace Transforms	5	1	0	6
UMA20202T	Calculus	5	1	0	6
UMA20203T	Vector calculus, Fourier series and Transforms	5	1	0	6
UCD20S02L	Quantitative Aptitude and Reasoning	0	0	2	1
UJK20201L	Communication Skills	0	0	4	2
UNS20201L	NSS	0	0	0	0
UNC20201L	NCC				
UNO20201L	NSO				
UYG20201L	YOGA				
Total Learning Credits					24
Total number of hours /week					30

Semester – III

Code	Course Title	Hours/ Week L	T	P	C
UMA20301T	Probability and Statistics	5	1	0	6
UMA20D01T	Number Theory	5	1	0	6
UMA20D02T	Operations Research				
UMA20D03T	Combinatorics				
UPY20A01J	Allied Physics	4	0	4	6
UMA20S01L	C Programming	0	0	4	2
UMA20S02L	JAVA Programming				
UMA20S03L	Scientific Documentation and Statistical Tools	0	0	4	2
UMA20S04L	PYTHON Programming				
UJK20301T	Universal Human values	2	0	0	2
Total Learning Credits					24
Total number of hours /week					28

Semester - IV

Code	Course Title	Hours/ Week L	T	P	C
UMA20401T	Discrete Mathematics	5	1	0	6
UMA20D04T	Fuzzy Mathematics	5	1	0	6
UMA20D05T	Introduction to Partial Differential Equations				
UMA20D06T	Astronomy				
UCY20A03J	Allied Chemistry	4	0	4	6
UMI20S01L	My India Project	0	0	0	1
UMA20S05L	Mathematical Software MATLAB	0	0	4	2
UMA20S06L	Mathematical Software SCILAB				
UJK20401T	Professional skills	2	0	0	2
Total Learning Credits					23
Total number of hours /week					24

Semester –V

Code	Course Title	Hours/ Week L	T	P	C
UMA20501T	Algebraic Structures	5	1	0	6
UMA20502T	Real Analysis	5	1	0	6
UMA20D07T	Graph Theory	5	1	0	6
UMA20D08T	Sequence and Series				
UMA20D09T	Linear Algebra				
UES20AE1T	Environmental Studies	3	0	0	3
UJK20501T	Leadership and Management skills	2	0	0	2
Total Learning Credits					23
Total number of hours /week					23

Semester - VI

Code	Course Title	Hours/ Week L	T	P	C
UMA20601T	Complex Analysis	5	1	0	6
UMA20602T	Mechanics	5	1	0	6
UMA20D10L	Project Work	0	0	12	6
Total Learning Credits					18
Total number of hours /week					24

9. Program Articulation Matrix

Course Code	Course Name	Programme Learning Outcomes														
		Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
UMA20101T	Algebra and Trigonometry	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20102T	Analytical Geometry	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20103T	Numerical Analysis	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H
UMA20201T	Differential Equations and Laplace Transforms	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20202T	Calculus	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H
UMA20203T	Vector calculus, Fourier series and Transforms	H	H	H	M	H	H	M	H	H	H	M	H	L	H	H
UMA20301T	Probability and Statistics	H	H	H	M	H	H	M	H	H	H	M	H	L	H	H
UMA20401T	Discrete Mathematics	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20501T	Algebraic Structures	H	H	H	M	H	H	H	H	H	H	M	H	L	H	H
UMA20502T	Real Analysis	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20601T	Complex Analysis	H	H	H	H	H	H	H	H	H	H	M	H	L	H	H
UMA20602T	Mechanics	H	H	H	M	H	H	H	H	H	H	M	H	L	H	H
UMA20D01T	Number Theory	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H
UMA20D02T	Operations Research	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
UMA20D03T	Combinatorics	H	H	H	H	H	H	H	H	H	H	M	H	H	H	M
UMA20D04T	Fuzzy Mathematics	H	H	M	M	M	H	H	H	H	H	M	H	M	M	M
UMA20D05T	Introduction to Partial Differential Equations	H	H	H	M	H	H	H	H	H	H	H	H	H	H	H
UMA20D06T	Astronomy	H	M	H	L	H	H	H	H	H	H	M	H	H	H	H
UMA20D07T	Graph Theory	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
UMA20D08T	Sequence and Series	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
UMA20D09T	Linear Algebra	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H
UMA20D10L	Project Work	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H
ULT20G01J	Tamil-I	H	H	H	M	H	H	M	H	H	H	H	H	M	H	H
ULH20G01J	Hindi-I	H	H	H	M	H	H	M	H	M	H	H	H	H	H	H
ULF20G01J	French-I	H	H	H	H	H	H	M	H	H	H	H	H	H	H	H
ULT20G02J	Tamil-II	H	H	H	M	H	H	M	H	H	H	H	H	M	H	H
ULH20G02J	Hindi-II	H	H	M	H	H	H	H	H	M	H	H	H	M	H	H
ULF20G02J	French-II	H	H	M	H	H	H	H	H	M	H	H	H	M	H	H
UPY20A01J	Allied Physics	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H
UCY20A03J	Allied Chemistry	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H
UMA20S01L	C Programming	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UMA20S02L	JAVA Programming	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UMA20S03L	Scientific Documentation and Statistical Tools	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UMA20S04L	PYTHON Programming	H	H	H	H	H	H	H	H	H	H	L	H	H	M	H
UMA20S05L	Mathematical Software MATLAB	H	H	H	H	H	H	H	H	H	H	L	H	H	M	H
UMA20S06L	Mathematical Software SCILAB	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UMI20S01L	My India Project	H	H	M	M	M	H	H	M	H	H	H	M	M	H	H
UCD20S01L	Soft Skills	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UCD20S02L	Quantitative Aptitude and Reasoning	H	H	M	M	M	H	H	M	H	H	H	M	M	H	H
ULE20AE1T	English	H	H	H	H	H	H	M	H	H	H	H	H	H	H	H
UES20AE1T	Environmental Studies	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UJK20201L	Communication Skills	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
UJK20301T	Universal Human Values	H	H	M	H	H	H	H	H	M	H	H	H	H	H	H
UJK20401T	Professional skills	H	H	H	H	H	H	M	H	H	H	L	H	M	M	H
UJK20501T	Leadership and Management skills	H	H	M	M	M	H	H	M	H	H	H	M	M	H	H
	Program Average	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H – High Correlation, M – Medium Correlation, L – Low Correlation

Course Structures									
Semester	**Professional Core Courses (CC)**	**Discipline Specific Electives (DSE)**	**Generic Electives(GE)**	**Life Skill (Jeevan Kaushal)**	**Skill Enhancement Courses(SEC)**	**Ability Enhancement Compulsory Courses(AECC)**	**Extension Activity**	**Total Credits**	**No. of Periods**
Sem I	CC-1(6) CC-2 (6) CC-3 (6)	-	GE-1 (3)- Tamil/Hindi/French-I		SEC-Soft skills(1)	AECC-English(4)		**26**	**30**
Sem II	CC-4(6) CC-5(6) CC-6 (6)	-	GE-2 (3)- Tamil/Hindi/French-II	JK1(2)- Com.Skills	SEC-Quantitative Aptitude & Reasoning(1)		NSS/NCC/NSO /Yoga(0)	**24**	**30**
Sem III	CC-7(6)	DSE-1(6)	GE-3 (6)- Allied Physics	JK2(2)-UHV	SEC- 1 (2) SEC-2 (2)			**24**	**28**
Sem IV	CC-8(6)	DSE-2(6)	GE-3 (6)- Allied Chemistry	JK3(2)- Prof..Skills	SEC-3 -My India Project (1) SEC-4(2)			**23**	**24**
Sem V	CC-9(6) CC-10(6)	DSE-3(6)	-	JK4(2)- Leadership & Management Skills		AECC-EVS(3)		**23**	**23**
Sem VI	CC-11(6) CC-12 (6)	DSE-4 (6)- Project						**18**	**24**
Total Credits	**72**	**24**	**18**	**8**	**8**	**8**	**0**	**138**	**159**

Course Code	ULT20G01J	Course Name	Tamil-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-1 :	*To enable them to learn the nuances of modern poetry in Tamil*																		
CLR-2 :	To explore New historicism through the works of art written in Tamil to enlighten the students to understand the changes in the modern society																		
CLR-3 :	Inculcate Ways of life, moralities and ethical factors as an essential part of learning Tamil literature																		
CLR-4 :	Develop strategies of comprehension of texts of different origin																		
CLR-5 :	Strengthen the language of the students both in oral and written																		
CLR-6 :	Express their sentiments, emotions and opinions, reacting to information, situations																		
CLO-1 :	*Extend and expand their savoir-faire through the acquisition of skills to cater the needs of the modern era.*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*H*	*H*	*M*	*H*	*H*	*-*	*H*	*H*	*H*	*H*	*H*
CLO-2 :	Enable the students to appreciate their mother tongue and to Enhance their thinking capacity	*2*	*80*	*70*	*H*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-3 :	Make them learn the basic rules of Language and make them communicate better	*2*	*70*	*65*	*H*	*H*	*H*	*M*	*-*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-4 :	Develop strategies of comprehension of texts based on different culture and life styles	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*-*	*M*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-5 :	Strengthen spoken and written skills of the student	*2*	*80*	*70*	*-*	*H*	*-*	*M*	*-*	*H*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-6 :	*Will be able to clear government examinations*	*2*	*75*	*70*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	தமிழ் இலக்கியப் போக்குகள்	நவீன கவிதை தோற்றம்	தமிழரின் வீரமரபு	சிற்றிலக்கியத் தோற்றம்	மொழி வரலாறு
	SLO-2	இலக்கிய நுட்பங்கள்	நவீன கவிதை வரலாறு	போர் விழுமியங்கள்	சிற்றிலக்கிய வகைமை	மொழிப் பயிற்சி
S-2	SLO-1	தமிழ்க் கவிதை மரபு	நவீன கவிதை செல்நெறிகள்	பரணி அறிமுகம்	சிற்றிலக்கியங்கள்	தமிழும் அகராதியியலும்
	SLO-2	காலந்தோறும் கவிதை உள்ளடக்கம்	செல்நெறிகளில் கோட்பாடுகள்	பரணி இலக்கியங்கள்	முதன்மைச் சிற்றிலக்கியங்கள்	அகரவரிசைப்படுத்தல்
S-3	SLO-1	காலந்தோறும் கவிதை வடிவம் –	கவிதை மொழி	கலிங்கத்துப்பரணி (484)	புதுக்கவிதையும் இதழ்களும்	கலைச்சொல் அறிமுகம்
	SLO-2	தற்கால இலக்கியம்	நவீன கவி மொழியின் நுட்பங்கள்	தலைவனின் வீரம்	மணிக்கொடி இதழ்	கலைச்சொல் உருவாக்க நுட்பங்கள்
S-4	SLO-1	புதுக்கவிதை உருவாக்கம்	நவீன கவி ஆளுமைகள்	தமிழ் இலக்கிய மரபில் தூது	எழுத்து இதழ்	தமிழில் கலைச்சொற்கள்
	SLO-2	புதுக்கவிதை செல்நெறிகள்	நவீன கவி ஆளுமைகளின் கவித்துவம்	தூது இலக்கியங்கள்	வானம்பாடி இதழ்	நிலைபெற்ற கலைச்சொற்கள்
S-5	SLO-1	பாரதியார் – காலத்தின் அடையாளம்	விளிம்புநிலை மனிதர்கள்	அழகர் கிள்ளைவிடு தூது (கண்ணிகள்)	சிறுகதை தோற்றம்	மரபுத்தொடர்
	SLO-2	பாரதியார் - பன்முக ஆளுமை	விளிம்புநிலை இலக்கியம்	தூது மரபில் கிளியும் பாராட்டும்	சிறுகதை வளர்ச்சி	தமிழில் மரபுத்தொடர்கள்
S-6	SLO-1	பாரதியார் - கண்ணன் என் சேவகன்	ராஜா சந்திரசேகரரின் கைவிடப்பட்ட குழந்தை	செய்யுள் மரபில் கலம்பகம்	சிறுகதை – வரலாறு	நாட்டார் வழக்காறுகள்
	SLO-2	கண்ணன் என் சேவகன் கவிதை	புறக்கணிப்பும் வாழ்வியலும்	கலம்பக இலக்கியங்கள்	சிறுகதை ஆசிரியர்கள்	பழமொழி அறிமுகம்

		சொல்லும் வாழ்வியல்				
S-7	SLO-1	20 ஆம் நூற்றாண்டுக் கவிதை மரபில் பாரதிதாசன்	புலம்பெயர்தல்	நந்திக் கலம்பகம் (77)	புதினம் தோற்றம்	தமிழில் பழமொழிகள்
	SLO-2	பாரதிதாசனும் தமிழும்	புலம்பெயர் வாழ்வியல்	மகள் மறுத்தலில் வீரம்	புதினம் வளர்ச்சி	பழமொழியும் பயன்பாடும்
S-8	SLO-1	பாரதிதாசன் – தமிழினி இனிமை,	அனார் - மேலும் சில இரத்தக் குறிப்புகள்	குறவஞ்சி அறிமுகம்	புதினத்தின் வகைமை	தமிழ் இலக்கண நுட்பங்கள்
	SLO-2	தமிழின் பெருமையும் வளமையும்	உள்நாட்டுப் போர்ச்சூழலும் பெண் உளவியலும்	குறவஞ்சி இலக்கியங்கள்	புதின ஆசிரியர்கள்	இலக்கணமும் பயன்பாடும்
S-9	SLO-1	வானம்பாடியில் அப்துல்ரகுமான்	காலந்தோறும் பெண்	குற்றாலக் குறவஞ்சி (9)	அச்சு ஊடக வரலாறு	தமிழில் சொல் வகைகள்
	SLO-2	அப்துல்ரகுமான் கவிதையின் தனித்தன்மைகள்	பெண் இலக்கியம்	மலையும் வாழ்வும்	அச்சு ஊடகமும் தமிழும்	சொல்லும் பயன்பாடும்
S-10	SLO-1	அப்துல்ரகுமான் - அவதாரம்	சுகிர்தராணியின் அம்மா	காப்பிய இலக்கணம்	அச்சு ஊடகமும் உரைநடை வளர்ச்சியும்	பெயர்ச்சொற்கள்
	SLO-2	அவதாரம் - நம்பிக்கையும் வெற்றியின் பாதைகளும்	பெண்மையும் தாய்மையும்	காப்பிய வகைமைகள்	தமிழில் உரைநடை	பெயர்ச்சொற்கள் அறிதல்
S-11	SLO-1	சுற்றுச்சூழலியல்	சமத்துவம்	தமிழில் பௌத்த இலக்கியங்கள்	சுவடிகள்	வினைச்சொற்கள்
	SLO-2	தமிழ்க் கவிதையில் சுற்றுச்சூழலியல்	பாலியல் சமத்துவம்	மணிமேகலை	சிவதருமோத்திரச் சுவடி பெற்ற வரலாறு	வினைச்சொற்கள் அறிதல்
S-12	SLO-1	நரசிம்மன் – மகனே என்னை மன்னித்து விடு	நா. முத்துக்குமாரின் தூர் கவிதை	பெண் சாபமும் காயசண்டிகையும்	புழங்குபொருள் பண்பாடும் தமிழர் வாழ்வியலும்	தமிழில் பெயரடை, வினையடை
	SLO-2	நவீன வாழ்வும் சுற்றுச்சூழலியல் அறிதலும்	தூர் கவிதை முன்வைக்கும் பெண் சமத்துவம்	பெண் வரலாற்றில் சாபங்களின் கதைகள்	கூஜாவின் கோபம்	பெயரடை, வினையடை அறிதல்

Learning Resources	1. **குறிஞ்சித்தேன், தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள், எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம், காட்டாங்குளத்தூர், 603203, 2020** 2. **வல்லிக்கண்ணன், புதுக்கவிதை தோற்றமும் வளர்ச்சியும், ஆழி பதிப்பகம், சென்னை, 2018** 3. **கா. சிவத்தம்பி, தமிழில் சிறுகதை தோற்றமும் வளர்ச்சியும், என்.சி.பி.எச்., சென்னை, 2013** 4. **தமிழ் இணையக் கல்விக்கழகம் -** http://www.tamilvu.org/ 5. **மதுரை தமிழ் இலக்கிய மின் தொகுப்புத் திட்டம் -** https://www.projectmadurai.org/

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Dr. R..Srinivasan Associate Professor, Department of Tamil, Presidency College, Chennai,	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*

		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

Course Code	ULH20G01J	Course Name	HINDI-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*HINDI*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*To be able to converse well in the Hindi Language*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	*To read and write and clarity*																		
CLR-3 :	*To be willing listeners and translators –where need be*																		
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*																		
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*																		
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To appreciate the Hindi language in its various forms.*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To understand the philosophy of life and living through stories.*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To help the students learn and develop the fundamentals of life, through One-Act plays.*	*2*	*70*	*65*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To share the richness of thought and content presented in the Hindi language, into other languages so that the readers would stand to gain.*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To guide the students in the learning of the technical aspect of the Hindi language, this would help them in the field of administration.*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*To encourage the students to communicate with the public, on a large scale with the medium of Main stream and Documentary films.*	*2*	*75*	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Kahani kya Hai	Ekanki aur Natak kya hai	Patrkarita ka arambh	Film Samiksha	Takniki Shabdavali
	SLO-2	Jivan ka anubhav	Vidhyarthiyon dono ke antar ko smajhkar apne dwara use prastut kar sakta hai	Vidhyarthiyon ka apne samaj ke prti jagrukta	Film ka prabhav ko smajhna	Vaignik tarike se bhashaon ka avishkaar karna
S-2	SLO-1	Kahani ke Tatva	EKANKI KA ARTH	Aazdi aur Patrkarita ka daiytava	SAMIKSHA KYA HAI	ARTH
	SLO-2	Vishleshan karne ki Kshmta	Vidhyarthi ke bhitar vishkleshan ki kshamta jagrit	Vidhyarthiyon ko patrkarita ka ihas smajkar samaj nirman ke liye sahyog dena	Tarkik vishleshan kshmta paida karta hai	Vidhyarthi uske arth dwara hi uske mahtav smjhenge
S-3	SLO-1	Vo Tera Ghar Ye Mera Ghar Parivar me Buzargon ke Mahtav ko Samjhana	PARIBHASHA	PATRKARITA KA MAHTAVA	SAMIKSHA KE PRAKAR	PARIBHASHA
	SLO-2	Bhartiya Sanskriti Se Vidhyarthiyon ko Jodna	Vidvano ke mat se parichay	Patrkarita se bhut se sawal ka smadhan ho jata hai	Vidhyarthiyon ka un prkaro ka adhyaan karna jisse vidhyarthi us samiksha ko tayaar kar payenge	Vibhinn vidwano dwara di gai paribhasha se us baat ko smjhenge vidhyathi
S-4	SLO-1	Mithaiwala Pyar Bantne se dukh kam hota hai	SWAROOP	PTRAKARITA KA ARTH	SAMIKSHA KA UDDESHYA	SHABDAVALI KI AVSHYAKTA
	SLO-2	Manavata ka Path	Vidhyarthiyon me iski samajh se lekhan kshmata badegi	Vibhinn vidhvono ko padhne se vidhyarthiyon ki tarkik kshmta badhti hai ,	Vidhyarthi ke andar smaj ke prati Kartavya bodh paida hoga	Vaignikon ka awiskar kitna mahtavpurn
S-5	SLO-1	Bechadri Pal Chatro me Utsah Vardhan Karna	PATHYA VACHAN	PTRAKARITA KI PARIBHASHA	FILM KA SAMAJIK MAHTAVA	BHASHA VAIGYANIK
	SLO-2	Beta-beti ek saman ke mahtav ko smjhana.	Vidhyarthiyon ka path kaushal bdhega	vidhvaono ki ukti ek smadhan bhi hota hai	Samajik uttar daiytav ko smjhana	Bhasha vaignikon ki jankari
S-6	SLO-1	Nadi aur Jeevan Paryavaran ke mahtav se awagat karana.	PRASTUTI	PRAMUKH SAMACHAR PATR	FILM KA VISHLESHAN	KARYALYIN SHABD
	SLO-2	Manav Jeevan me nadi ki upyogita aur Mahtav.	Natak khelne par bahut si takniki bate samajhenge	Vidhyarthiyon ki jankari badhegi	Vidhyarthi tarkik vishleshan sikhega	habd kaise tayar kiye jate hain vidhyorthiyon ko jankari

S-7	SLO-1	Pachees chauka Ded Sau Jamindari Pratha se awagat karana	MAHTVA	TV.PATRKARITA	DRISTIKON NIRMAN	ANGREZI SE HINDI ANUVAD
	SLO-2	Asprishya Vicharao ke Prati Sakaratamak Bnana.	Natak ka mahtav ko majhkr samaj ke hito ke sath judna.	TV patrkar ke daiytav ko smajkar vidhyarthi ise apne rozgar se jod sakta hai	Vidhyarthi ka drishtikon nirmit hoga	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna
S-8	SLO-1	Kahani ka Uddeshya	PRASHAN-ABHYAS	PHOTO PATRKARITA	DOCUMENTRY FILM	HINDI SE ANGREZI ANUVAD
	SLO-2	Vidhyarthiyon ko Samaj se Jode rakhna	Vidhyarthiyon ka lekhan kshmata Badhna	Vidhyarthiyon me photo patrkarita ke mahtav ka smajh paida hona	Vidhyarthi samajik dharatal ki kathinai ko smajhkar desh se judega	Hindi adhikari aur anuvadak ke pad ke liye tayaar karna.
S-9	SLO-1	Kahani Lekhan	UDDESHYA	PRASTUTIKARAN	MAIN STREAM FILM	EK DIN EK SHABD
	SLO-2	Vidhyarthi Ko likhne ki aur Prerit karna	Vidhyarthi ko smaj upyog hito ki jankari dena	Vifhyarthi apni baat rakhne ki kshmta vikstit karta hai	Vidhyarthion ko jivan ke anchue pahluon se bhi sakshaktkar	Vidhyarthiyon ko rozgaar se jodna
S-10	SLO-1	Seminar	PARICHARCHA	BHASHA-SHAILI	FILM KE DARSHAK	ATI MAHTVAPURN SHABD
	SLO-2	Vidhyarthiyon dwara Prastuti karan	Vidhyarthi me vak-kaushal bdhana	Vidhyarthi ko apni report me bhasha-shaili ko sikh kar ek badhiya reporter ban sakta hai	Vidhyarthiyon ka samajik gyan	Shabdon ke mahtav ko smajhkar use yaad karna
S-11	SLO-1	Prashan Abhyas	BHASHA SHAILI	PATRKARITA KE NIYAM	FILM AUR BAZAAR	SAMANYA SHABD AUR PARIBHASHIK SHABDAVALI ME ANTAR
	SLO-2	Vidhyarthiyon me Lekhn Kaushal ki kshmata Viksit karna.	Vidhyarthiyon ko bhasha ka mahtav smjhna	Vidhyarthi ise sikh kar ek nyay priya patrkar ban sakta hai	Vidhyarthiyon ko rozgaar se jodna	Vidhyarthiyon ko vaighniko dwara tayaar ki gai bhasha ki samaj
S-12	SLO-1	Path-Punravarti	EKANKI AUR RANGMANCH	PATRKAR KA DAIYTVA	FILM DARSHAK KA MAHTAVA	PARIBHASHIK SHABDAVALI KA MAHTAV
	SLO-2	Pariksha ke liye Saksham	Vidhyarthi isse rangmanch ke mahtav ko smajhenge	Vidhyarthiyon ko patrkar ka daityva sikhkar smaj ke uttar daityva ko nibhana hai	Vidhyarthiyon ko darshak ki ruchiyon se awagat karvana	Rozgaar se vidhyarthiyon ko jodnaw

Learning Resources	***The Prescribe Text Book Compiled and Edited by Department of Hindi*** www.gadyakosh.com www.shabdkosh.com

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

Course Code	ULF20G01J	Course Name	French-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*Extend and expand their savoir-faire through the acquisition of current scenario*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French																		
CLR-3 :	Make them learn the basic rules of French Grammar.																		
CLR-4 :	Develop strategies of comprehension of texts of different origin																		
CLR-5 :	Strengthen the language of the students both in oral and written																		
CLR-6 :	Express their sentiments, emotions and opinions, reacting to information, situations																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To acquire knowledge about French language*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*70*	-	*H*	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*To develop content using the features in French language*	*2*	*85*	*75*	*H*	-	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-4 :	*To interpret the French language into other language*	*2*	*70*	*80*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-6 :					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	**Bonjour, ça va ?**	**Salut ! Je m'appelle Agnès**	**Qui est –ce ?**	**Dans mon sac, j'ai…**	**Il est comment ?**
	SLO-2	**Salut**	**Paul, Valérie, Manish**	**Les exemples**	**Da ns ton sac**	**Les objectifs**
S-2	SLO-1	Les pays	Les pronoms personnels sujets	Les professions	La formation du féminin (3)	L'aspect physique
	SLO-2	Les nationalités	Je, Tu, Il/Elle Nous, vous, Ils/Elles	Les exemples	Les féminins	Le corps
S-3	SLO-1	Les animaux domestiques	Les verbes être et avoir	Quelques objets	La phrase interrogative	Le caractère
	SLO-2	Les animaux	Les verbes auxiliaires	Objets	Les interrogatives	Les exemples
S-4	SLO-1	Les jours de la semaine	Les articles définis et indéfinis	La fiche d'identité	*qu'est – ce que.. ?*	Les prépositions de lieu (1)
	SLO-2	Les mois de l'année	Les exemples	La carte d'identité	*Les exemples*	Dans, sur, sous etc..,
S-5	SLO-1	Les nombres de 0 à 69	La formation du féminine (1)	La liaison	*Qu'est – ce que C'est*	Les nombre à partir de 70
	SLO-2	Les nombres	Les féminins	Les activités	*Les objets*	Les exemples
S-6	SLO-1	La famille (1)	La formation du pluriel (1)	L'élision	*Qui est – ce ?*	**Allo ?**
	SLO-2	Ses parents	Les exemples	Les activités	*Les personnes*	**Portable**
S-7	SLO-1	L'accent	Les adjectifs possessifs	Intonation descendre	*la phrase négative*	La formation du féminin(3)
	SLO-2	L'accent tonique	Les exemples	Les descendre	*La négation*	Les exemples
S-8	SLO-1	Les articles définis	Entrer en contact : salut	Intonation montante	*C'est*	Les articles contractés
	SLO-2	Les articles indéfinis	Entrer en contact : demander	Les montantes	*Il est*	Les articles partitifs
S-9	SLO-1	Bonjour, - Salut !	Dire comment ça va	Dans mon sac	*Les verbes du premier group*	Les pronoms personnels toniques
	SLO-2	Ca va	Comment allez-vous ?	Des objets	*Les exemples*	Les pronoms
S-10	SLO-1	Je m'appelle Agnès	Se présenter	Les Mots	Les verbes *aller*	Les adverbes interrogatifs
	SLO-2	Quel est votre nom	Présenter quelqu'un	Les expressions	Le verbe venir	Les interrogatifs
S-11	SLO-1	Les Mots	*Demander*	Demander poliment	Demander et répondre poliment	Les verbes du deuxième group
	SLO-2	Les Expressions	*Demander le temps*	Répondre poliment	Les exemples	Les exemples
S-12	SLO-1	Entrer en contact	Demander la date	Demander des informations personnelles	Demander des informations personnelles	Décrire l'aspect physique

	SLO-2	Se présenter.	Dire la date	Les exemples	Les activités	Décrire le caractère

Learning Resources	***Theory:*** ***1.*** ''**Génération-AI''** Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018. ***2. Cahier d'activités avec deux discs compacts.***

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

Course Code	ULE20AE1T	Course Name	English	Course Category	A	Ability Enhancement Course	L	T	P	C
							4	0	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*Extend and expand the integrity in an individual which shall never allow him/her to compromise upon a noble way of living*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	Enable the students to overcome the fear of speaking a foreign language and enable them to think through a foreign language.																		
CLR-3 :	Make them communicate an unbiassed way of thinking in a better manner																		
CLR-4 :	Develop strategies of comprehension of texts based on different culture and life styles																		
CLR-5 :	Strengthen spoken and written skills of the student in English																		
CLR-6 :	Help them express their sentiments, emotions and opinions, and reactions to information and situations in a civilized, cultured and humane manner.																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To acquire knowledge of becoming better beings through the tools of Language and Literature*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*-*	*H*	*-*	*H*	*-*	*H*	*H*	*H*	*-*	*-*	*-*
CLO-2 :	*To acquire a strong knowledge on concept, culture, civilization through English Literature*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*-*	*-*
CLO-3 :	*To develop own content and to be able to translate using the features in English Language*	*2*	*70*	*65*	*H*	*-*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*-*	*-*
CLO-4 :	*To interpret the contents in the texts presented in English Language*	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-5 :	*To present an improved and healthier communication and intercultural elements acquired through English Literature*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-6 :	*To participate in any level of conversation and discussion presented in English with both proficiency in the language and positive caliber in the content of speech*	*2*	*75*	*70*	*H*	*H*	*-*	*H*	*M*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Introduction to the art of poetry writing will be done*	*Post-colonial impacts in India as observed in their language and culture will be discussed.*	*Story through images is explained to the students*	*The definition and purpose of monologue is explained*	Homophones and Homonyms are to be explained in the class along with examples of usage.
	SLO-2	*The rationale behind this unit will be discussed.*	*The students will be encouraged to impart their views*	*The students are asked to create their own stories from those images*	*the sample monologues are to be provided to the learners*	How where and when these as vocabulary can be used is to be explained
S-2	SLO-1	*Feminism through Kamaladas' poem' In Kindergarten' is explained*	*Mathraboothan and the mother tongue influence in English – a discussion*	*Every day the students are made to bring their own cartoons to tell stories related to social issues and political issues.*	*The learners are made to create their own monologue contents.*	*Cross word puzzles are to be given to the students to make them understand the differences and usage of homophones and homonyms*
	SLO-2	*feminist critique's stand through poets like Meena Kandasamy is discussed*	*Students from different regions are asked to talk. The peculiarity in their pronunciation is to be identified by them*	*How to identify irony and sarcasm is taught*	*The contents are assessed and the lacuna is informed*	*The students are evaluated by making them use homophones and homonyms on their own*
S-3	SLO-1	*The writer Meena Kandasamy is invited to read her poems on women.*	*Enjoywithinlimits, says Mr Mathruboothamistaught and discussed*	*International Political memes to be created in the class*	*Discuss the contents created by the students and reiterate the idea that a monologue should mimic a story and has to have a proper beginning middle and an end.*	*How exactly to decide a proper word at a given situation is to be practically explained in the class.*
	SLO-2	*Questions on her perspectives are to be posed by the students*	*Everymistakefound in the textisanalysed*	*Memes on popular issues to be created in the class*	*The created monologues are to be assessed by the students themselves*	*Mundane situations are to be given to the students to check their ability to use those words*

S-4	SLO -1	*Gender inequality is discussed through A K Ramanujam and his poetry*	*The structure of sentence in English and the distorsion of the sentence isverified*	*Autobiography and biography differences are explained*	*To ask the students to bringnewspaper to class and makethem select a column and readitloudly.*	*To give all the parts of speech not according to the grammar book order but according to a method which would easily make one understand correlation of one with the other. For instance – Noun, Pronoun, Adjective, Verb, Adverb… will have to be the order*
	SLO -2	*Different legal situations where both the genders suffer is explained in the class*	*Diffèrent sentences are given and tested*	*Certain Classic autobiographies and biographies are presented*	*No meaningis to beexplained. Just the flow is to bechecked.*	*The students are made to use as many adjectives as possible for describing their friends*
S-5	SLO -1	*Kalki the poetisinvited to conduct a guets lecture on herownpoem.*	*Nobel? What Nobel, asks MrMathrubootham is discussed*	*How to give voice to an inanimate object.*	*Another reading loud session of the same passages are to be conducted along with dictionary checking for meanings are to be done.*	*The parts of speech must beused in different sentences*
	SLO -2	*Questions on her perspectives are to be posed by the students*	*The attitudes of people in a ludicrous manner is discussed*	*Different objects are given to the students and they are asked to give autobiographical notes to them*	*The new meanings that the students get must be compared with the given word and the distance between the meanings are to be explained*	*the teacherought to use the board to draw a situation to make one understandeachpart's usage.*
S-6	SLO -1	*Seminar to generate discussion to enhance gender sensitivity is conducted*	*The Text is analyzed in detail*	*Practically test the students in class by giving them different concrete objects.*	*To make them compare and realize how they had overcome their fear for English*	*Along with parts of speech particularly when Verb is being taught Tenses ought to be taught with same methodology mentioned above.*
	SLO -2	*Case studies are to be incorporated by the students in their seminar*	*More insights into Indian English is given*	*Ask the students to evaluate each other's autobiography on concrete objects*	*The comprehensive techniques are taught*	*The students are asked to create a lighter vein situation and asked to use all the tenses*
S-7	SLO -1	Human interest columns in news papers - tragedies on women men and transgender documented is read aloud and discussed in the class room.	*Neutral accent is taught along with right pronunciation*	*Caption writing is taught*	*To develop the ability to pick up a conversation istaugh*	*The rules of Tenses are taught with live examples in the classes.*
	SLO -2	. how much are the students able to relate with or able to feel emotionally for those situations is to be checked and analysed	*Test is to be conducted to check how far a student is able to understand neutral accent*	*The purpose of the caption writing is to be instilled*	*to engage in conversations and be able to interupt and end conversation appropriatelywillbetaught*	*Ability to use all the rules in tenses is taught.*
S-8	SLO -1	*Case studies to be given to the students to document their reactions*	*Mr Mathruboothamisfullysupporting all new technologies – discussion*	*Different examples for captions are given*	*Different situations to be given to the students to engage in a conversation.*	*The basic way to pick an error is by already knowing the rules of grammar thoroughly.*
	SLO -2	*Find out if there is any student finding it hard to emote or is insensitive toward the moment*	*Humor and sarcasmisskimmedfrom the text*	*The studenst are asked to create captions similar to the ones shown in the class*	*The students are asked to find errors in each others' monologue*	*Hence all the rules are to be brushed up*
S-9	SLO -1	*Students are to made to createtheirownenactable content on the prevailinggenderinequalities*	*How to write a statement and question is to be taught with reference to the text.*	*The students are made to give captions different news articles, products and situations*	*To test how much one is able to use ironyhumor and sarcasm in one's conversation*	*Excercises on all sorts of possible errors are given to the students and asked to rectify.*
	SLO -2	*The students are asked to improvise on dialogue on theirown*	*The way sentences are constructed according to the regional impact is discussed*	*The best is appreciated for its qualities of being best*	*Natural usage of punisexplained*	*Mathrabootham's passages are given to the studentsagain to check the errors.*
S-10	SLO -1	*Feminism vs Gender inequality a test for the students to chart out the existing gulf*	*Pizza maavu : Welcome to Mr Mathruboothamfoodrecipiewebsiteisdiscussed*	*Public Speakingexamplessince Julius Caesar to Martin Luther isgiven*	*To teachdifferentkinds of reading. -skimming scanning and intensive reading extensive reading is taught*	*Definesynonym and antonym. Ask the sudents to identifysynonyms and antonyms in text.*

	SLO -2	*False allegations and Legal situations sometimes created by women to corner men only degrades the freedom struggle of women – discuss*	*The students are made to explain the textthemselves*	*The techniques used by different leaders sinceagesisdiscussed*	*Teh students are practicallyasked to use thosemethodology to understand a text*	*Demonstartetheriunderstanding of synonyms and antonyms in active learning. Introduce thesaurus reference.*
S-11	**SLO -1**	*A detailed discussion on the 4 poets is done in the class through comparative method*	*Identify the errors and make students to rewrite first two texts*	*The Ted X talks are played in the class, different political leader's canvasing is presented*	*The students are made to read the passages loudly*	*Demeonstrateunderstanding of words by relatingthem to their opposites (antonyms)*
	SLO -2	*While comparison the students are able to get a deeper analytical way of thinking and are able to present an all encompassed points*	*Check if they are able to retain the humor in the text after correcting the sentences*	*What makes a talk impressive is identified and discussed*	*The students are asked questions from the passages to check their retention capacity*	*Demonstrateunderstanding of wordswithsimilar but not identicalmeanings (synonyms)*
S-12	**SLO -1**	*The comprehension and retention and application of all the acquired knowledge of the student is checked by initiating an informal discussion in the class.*	*Identify the errors and make the students to rewrite the last two texts*	*The students are givendifferent topics to give impromptu*	*The learner is made to select phrases and words from the given passages and is asked to use it in own sentences*	*With the studentsbrainstormshortlist of commonlyusedwords*
	SLO -2	*The overall development in the student's EQ pertaining to gender oriented issues will be sensible and objective.*	*Check if they are able to retain the humor in the text after correcting the sentences. Explain the result to them*	*The best talk isrecorded and made available for other'srefferences*	*The ability to converse with humor sarcasm or deep thoughts and with the capacity to emote the desired emotion in the other is checked*	*Askthem to rapidlygivesynonyms and antonyms to thosewords*

Learning Resources	***Theory:*** ***3.*** Horizon- English Text Book – Compiled and Edited by the Faculty of English Department, FSH, SRMIST, 2020 ***4.*** *English Gramar in Use by Raymond Murphy*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	30%	-	30%	-	30%	-	30%	-	30%	-
	Analyze										
Level 3	Evaluate	40%	-	40%	-	40%	-	40%	-	40%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

Course Code	UMA20101T	Course Name	ALGEBRA AND TRIGONOMETRY	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn rank of a matrix, orthogonal transformation of a matrix and solving differential equations using matrix	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To understand the relation between roots and coefficient of equations																		
CLR-3 :	Learn the concept of reciprocal equations																		
CLR-4 :	Study in detail the transformation of equations																		
CLR-5 :	Apply the concepts of matrices , in solving a system of linear equations																		
CLR-6 :	Get exposed to the transformation of equations and find the summation of Trigonometric series																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Know the fundamental application of theory of equations	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Identify the roots of symmetric functions in terms of coefficients of third degree equations	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Understand the concept of different methods of finding the roots of a polynomials	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Apply the concepts of matrices, in solving a system of linear equations.	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Associate Descartes' rule in finding the roots of a polynomials	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solve trigonometric series and logarithm of a complex number	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Introduction to type of matrices-Hermitian, Skew Hermitian and Unitary	Introduction to polynomial equations	Introduction to sum of the powers of the roots of an equation	Introduction to increase the roots of a given equation by a given quantity	Introduction to expansions of $\sin n\theta$
	SLO-2	Orthogonal and unitary matrices-properties-problems	Standard rational integral equation of nth degree	sum of the powers of the roots of an equation	Problems in increase the roots of a given equation by a given quantity	Problems in expansions of $\sin n\theta$
S-2	SLO-1	Linear dependency and linear independency of vectors	Fundamental theorem in the theory of equations	sum of the powers of the roots of an equation using coefficient of power of k+1	Decrease the roots of a given equation by a given quantity	Expansions of $\cos n\theta$
	SLO-2	Cramer's rule for system of linear equations-theorem with proof	Describe standard rational integral equation of nth degree	sum of the powers of the roots of an equation using coefficient of power of k-1	Problems in decrease the roots of a given equation by a given quantity	Problems in expansions of $\cos n\theta$
S-3	SLO-1	Solution of system of linear equations by Cramer's rule	Problems in polynomial equations	Problems in sum of the powers of the roots of an equation using detached coefficient division	Increase or decrease the roots of a given equation by a given quantity	Expansion of $\tan n\theta$
	SLO-2	Introduction to sub matrix of a matrix and minor of a matrix	Standard rational integral equation of nth degree types of solution	Solving problems in sum of the powers of the roots of an equation using detached coefficient division	Diminishing the roots of an equation	Problems in expansions of $\tan n\theta$
S-4	SLO-1	rank of a matrix-the rank of transpose of a matrix	Problems in Standard rational integral equation of nth degree	Newton's theorem on the sum of the powers of the roots	Problems Diminishing the roots of an equation	Expansions of $\sin^n\theta$, $\cos^n\theta$, and $\tan^n\theta$ in terms of $\cos\theta$ and $\sin\theta$
	SLO-2	Elementary transformations-equivalent matrices	Imaginary and irrational roots	Describe Newton's theorem on the sum of the powers of the roots	Removal of terms	Expand $\sin^n\theta$, $\cos^n\theta$ and $\tan^n\theta$ in terms of $\cos\theta$ and $\sin\theta$
S-5	SLO-1	Rank of a matrix-elementary transformations	Theorems in imaginary and irrational roots	Find sum of the powers of the roots	Compute square of roots by Removal of terms	Expansions of $\sin^n\theta$ in terms of multiple angles of θ
	SLO-2	Problems in finding the rank of a matrix	Finding the other roots of the equations from the given equation and its roots	Possible values of sum of powers of the roots	Problems in Removal of terms – square of the roots	Problems in $\sin^n\theta$ in terms of multiple angles of θ

S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Test for consistency of linear equations	Solving imaginary and irrational roots	Transformation of equations	Transformations in general	$\cos^n\theta$ in terms of multiple angles of θ
	SLO-2	Condition for consistency theorem with proof	Forming the equation from the given roots	Possible ways of transforming the equation	Problems in transformations in general	Express cosnθ in terms of cosines of multiples of θ
S-8	SLO-1	Consistency of systems of linear equations-unique solution	Problems in imaginary and irrational roots	Multiplication of roots by m	Transforming the equations by removal of terms	Expansion of $\tan\theta$
	SLO-2	Consistency of systems of linear equations-many solutions	Problems in imaginary and irrational roots	Form the equation whose roots are multiplied by m	Form the new equation by Transforming the equations by removal of terms	Introduction to hyperbolic functions and their properties
S-9	SLO-1	Inconsistency of systems of linear equations	Introduction relation between roots and coefficients of equations	Problems in forming the equation	Problems in transformations in general	Problems in hyperbolic functions and their properties
	SLO-2	Problems in solutions of systems of linear equations	Solving the equations whose roots are in A.P	roots of the equation in A.P	Descarte's rule of signs	inverse hyperbolic functions and their properties
S-10	SLO-1	Eigen values of matrices	Solving the equations whose roots are in A.P	Form the equation whose roots are the squares of the difference of roots of the given equation	Problems in Descarte's rule of signs	Problems in inverse hyperbolic functions and their properties
	SLO-2	Eigen vectors of matrices	Solving the equations whose roots are in G.P	Solving roots of the equation with sign changed	Descarte's rule of signs for negative roots of an equation	Eulers's formula and Formula for $\sin\theta$ and $\cos\theta$ in terms of exponential functions
S-11	SLO-1	Properties of Eigen values –proof	Problems in relation between roots and coefficients of equations	Problems in roots with sign changed	Find possible real roots - Descarte's rule of signs	Periodicity of exponential functions, Addition formulae
	SLO-2	Properties of Eigen vectors –proof	Solving the equations whose roots are in H.P	Problems in roots with sign changed	Imaginary roots - Descarte's rule of signs	Relation between circular and hyperbolic functions
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Problems in Eigen values and Eigen vectors	Solving the equations whose roots are in H.P	Roots multiplied by a given number	Horner's method	Addition formulae for hyperbolic functions
	SLO-2	Properties of Eigen values and Eigenvectors	Symmetric functions of roots in terms of coefficients of third degree equation	Problems in Roots multiplied by m	Real root – Horner's method	Periods of hyperbolic functions
S-14	SLO-1	Introduction to Cayley Hamilton theorem with proof	Problems in symmetric functions of roots in terms of coefficients of third degree equation	Solving problems in Roots multiplied by a given number	Positive roots-Horner's method	Introduction to logarithm of a complex number
	SLO-2	Cayley Hamilton theorem-characteristic polynomial	Problems in symmetric functions of roots in terms of coefficients of third degree equation	Reciprocal equations	Negative roots - Horner's method	Real parts of logarithm of a complex number
S-15	SLO-1	Problems in Cayley Hamilton theorem	Solving cubic equations by cardano's method	Properties of a reciprocal equation	Solving more problems in Horner's method	Imaginary parts of logarithm of a complex number
	SLO-2	Computing inverse of a matrix and integral power of the matrix	Problems in cubic equations by cardano's method	Condition for an equation to be a reciprocal equations	Newton's method	Problems in real and imaginary parts of logarithm of a complex number
S-16	SLO-1	Introduction to Diagonalisation of Matrices by similarity transformation	Problems in cubic equations by cardano's method	Solving the reciprocal equation of odd degree with like signs	Real root - Newton's method	Logarithm of a negative real number
	SLO-2	Problems in Diagonalisation of Matrices	Computing cubic equations by eliminating square term	Solving the reciprocal equation of odd degree with unlike signs	Find the real root of an equation - Newton's method	Problems in logarithm of a negative real number
S-17	SLO-1	Introduction to Diagonalisation of Matrices by Orthogonal transformation	Solving cubic equations by comparing the product and sum	Solving the reciprocal equation of even degree	Negative root of an equation - Newton's method	General and principal values
	SLO-2	Problems in Diagonalisation of Matrices by Orthogonal transformation	Finding the roots of cubic equations by cardano's method	Solving the reciprocal equation of even degree with middle term missing	Newton's method, Horners method to find roots of an equation	Problems in general and principal values
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Calculus, Vol.I, S. Narayanan and T K Manicavachagom Pillay, S. ViswanathanPrinters and Publishers Pvt. Ltd., 2010 2. Calculus Vol.II, S. Narayanan and T K Manicavachagom Pillay, S. ViswanathanPrinters and Publishers Pvt. Ltd., 2010. 3. Advanced Engineering Mathematics by H.K. Doss, S.Chand, 2008	4. Mathematics,Volume 1, P. Kandasamy and Thilagavathy, S. Chand, New Delhi, 2004. 5. Calculus, Thomas and Finney, Pearson Education, 9th Edition, 2006.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Prof. .S. Ganapathy Subramanian, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mr. J. Sasi Kumar, SRMIST Dr. K. Sheena Christy, SRMIST

Course Code	UMA20102T	Course Name	ANALYTICAL GEOMETRY	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn about conics in polar coordinates.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To understand about straight lines in three dimension.																		
CLR-3 :	To gain knowledge about sphere, properties involving plane section of a sphere.																		
CLR-4 :	To gain knowledge about cone																		
CLR-5 :	To gain knowledge about cylinder																		
CLR-6 :	To learn the concepts of conicoides																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Derive equations of conics in polar coordinates and to solve simple problems	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Derive equation of straight lines in different forms and to understand the properties of straight lines	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Solve problems in sphere and plane section of the sphere	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Derive and solve problems in cone and right circular cone	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Derive and solve problems in cylinder and right circular cylinder	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solve problems in conicoids and derive the condition of tangency	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module- V (18)
S-1	SLO-1	Introduction to conics	Introduction to straight line in three dimension	Introduction to Sphere	Introduction to cone	Introduction to conicoids
	SLO-2	Introduction to polar coordinates	Equation to straight line in symmetric form	Introduction to Sphere	Introduction to cone	Introduction to conicoids
S-2	SLO-1	Derivation of conics in polar coordinates	Equation of straight line in general form	Equation of Sphere passing through four given points	General Equation of a cone	Standard types of conicoids
	SLO-2	Derivation of conics in polar coordinates	Equation of straight line in general form	Equation of Sphere passing through four given points	General Equation of a cone	Standard types of conicoids
S-3	SLO-1	Classification of conics in polar coordinates	Conditions for the straight line to be Parallel	Equation of Sphere passing through end points of the diameter	Right Circular cone	Graphical representation of types of conicoids
	SLO-2	Problems to identify the types of conic	Conditions for the straight line to be Parallel	Equation of Sphere passing through end points of the diameter	Right Circular cone	Graphical representation of types of conicoids
S-4	SLO-1	Problems to find the equation of a conic with given directrix and eccentricity	Conditions for the straight line to be Perpendicular	Properties of Sphere	Equation of a cone with given vertex and guiding curve	General equation of the central conicoid
	SLO-2	Problems to find the equation of a conic with given directrix and eccentricity	Conditions for the straight line to be Perpendicular	Properties of Sphere	Equation of a cone with given vertex and guiding curve	General equation of the central conicoid
S-5	SLO-1	To find the Graphical representation of a conic	Condition that a line will lie on a Plane	Problems with Plane and a Sphere	Equation of cone with vertex as origin	Simple problems
	SLO-2	To find the Graphical representation of a conic	Condition that a line will lie on a Plane	Problems with Plane and a Sphere	Equation of cone with vertex as origin	Simple problems
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Deriving the Equation of Directrix of a conic	Intersection of line and a Plane	Condition for a plane to touch a sphere	Equation of cone with three axes as its generators	Equation of the tangent plane to the central conicoid

	SLO-2	Deriving the Equation of Directrix of a conic	Intersection of line and a Plane	Condition for a plane to touch a sphere	Equation of cone with three axes as its generators	Equation of the tangent plane to the central conicoid
S-8	SLO-1	Problems related to Directrix of a conic	The necessary and sufficient condition that the two lines will be coplanar	Point of contact of plane and a sphere	Simple problems	Simple problems
	SLO-2	Problems related to Directrix of a conic	The necessary and sufficient condition that the two lines will be coplanar	Point of contact of plane and a sphere	Simple problems	Simple problems
S-9	SLO-1	Deriving the Equation of chord of a conic	Condition of coplanarity of two lines, one in general form and the other in symmetric form	Tangent plane of a sphere	Condition that a general equation of second degree may represent a cone	Necessary and Sufficient conditions for a plane to touch the central conicoid
	SLO-2	Deriving the Equation of chord of a conic	Condition of coplanarity of two lines, one in general form and the other in symmetric form	Tangent plane of a sphere	Condition that a general equation of second degree may represent a cone	Necessary and Sufficient conditions for a plane to touch the central conicoid
S-10	SLO-1	Problems related to chord of a conic	Condition of coplanarity of two lines, both in general form	Plane section of a sphere	Equation of a cone with vertex, axis and semi-vertical angle	Simple problems
	SLO-2	Problems related to chord of a conic	Condition of coplanarity of two lines, both in general form	Plane section of a sphere	Equation of a cone with vertex, axis and semi-vertical angle	Simple problems
S-11	SLO-1	Problems related to conics	Condition of coplanarity of two lines, both in symmetric form	Problems in Plane section of a sphere	Simple problems	Point of contact of the tangent plane to the conicoid
	SLO-2	Problems related to conics	Condition of coplanarity of two lines, both in symmetric form	Problems in Plane section of a sphere	Simple problems	Point of contact of the tangent plane to the conicoid
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Deriving the Equation of Tangent of a conic	Angle between two lines	Condition for Two Spheres to touch internally and Externally	Enveloping cone of a sphere	Simple problems
	SLO-2	Deriving the Equation of Tangent of a conic	Angle between two lines	Condition for Two Spheres to touch internally and Externally	Enveloping cone of a sphere	Simple problems
S-14	SLO-1	Problems related to Tangent of a conic	Angle between a line and a Plane	Equation of sphere through the circle of intersection of two sphere	**Introduction to cylinder**	Locus of the point of intersection of three mutually perpendicular tangent planes to a conicoid
	SLO-2	Problems related to Tangent of a conic	Angle between a line and a Plane	Equation of sphere through the circle of intersection of two sphere	**Introduction to cylinder**	Locus of the point of intersection of three mutually perpendicular tangent planes to a conicoid
S-15	SLO-1	Deriving the Equation of Normal of a conic	Equation of two skew lines in symmetric form	Equation of sphere through the circle of intersection of two sphere	General Equation of a cylinder	Simple problems
	SLO-2	Deriving the Equation of Normal of a conic	Equation of two skew lines in symmetric form	Equation of sphere through the circle of intersection of plane and a sphere	General Equation of a cylinder	Simple problems
S-16	SLO-1	Problems related to Normal of a conic	Shortest distance between two skew lines	Equation of sphere through the circle of intersection of plane and a sphere	Right circular cylinder	Director sphere and Director plane
	SLO-2	Problems related to Normal of a conic	Shortest distance between two skew lines	Equation of sphere through the circle of intersection of plane and a sphere	Right circular cylinder	Director sphere and Director plane
S-17	SLO-1	Problems related to conics	Shortest distance between two skew lines	**Angle of intersection of two spheres**	Simple problems	Simple problems
	SLO-2	Problems related to conics	Shortest distance between two skew lines	**Angle of intersection of two spheres**	Simple problems	Simple problems
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. P. Duraipandian, Laxmi Duraipandian , D.Muhilan, Analytical Geometry-3 Dimensional, Emerald Publishers, 1983. 2. G.S.Pandey, R.R.Sharma, Vectors and Geometry, Wishwa Prakashan.1988. 3. N.P. Bali, Solid Geometry, Laxmi Publications (P) Ltd, 2005.	4. T.K.Manicavachagom Pillay, T.Natarajan, A text book of Analytical Geometry- Part-I- Two Dimensions, Viswanathan Publications, 1986. 5. M.L.Khanna, Solid Geometry, Jai Prakashnath & Co Publishers, Meerut, 2008. 6. P.R.Vittal, Coordinate Geometry, Margham Publishers, 2003. 7. G.B.Thomas& R.L.Finney, Calculus & Analytic Geometry, Addison Wesley, Mass (Indian Print), 1998.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. S.Sangeetha, SRMIST Dr. S. Vidyanandini, SRMIST

Course Code	UMA20103T	Course Name	NUMERICAL ANALYSIS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Understand the methodologies to solve algebraic and transcendental equations	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Acquaint knowledge on direct and iterative methods to solve system of linear equations																		
CLR-3 :	Gain knowledge on interpolating and extrapolating methods in various intervals in real ife																		
CLR-4 :	Understand the concept of numerical differentiation and integration																		
CLR-5 :	Acquire knowledge of various techniques and methods to solve initial and final value problems in differential equations																		
CLR-6 :	Familiarise in applying various numerical methods in real life problems																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Solve algebraic and transcendental equations using numerical methods.	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Apply direct and iterative methods to system of linear equations	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Apply interpolating and extrapolating methods	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Compute numerical differentiation and integration	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Interpret initial and final value problems in differential equations	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Analyse and interpret various realistic cases using existing numerical methods	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction and review of fundamentals.	Introduction to Finite Differences	Introduction to Numerical differentiation	Numerical solution of ordinary differential equations	Numerical solution of parital differential equations
	SLO-2	Algebraic and transcendental equations	Forward and backward differences	Newton's forward difference formula for derivatives	Single step methods-	One dimensional Parabolic equation
S-2	SLO-1	**A solution of numerical equation by Bisection method**	Central difference	Numerical differentiation Examples	Taylor series method	Finite difference and mesh points
	SLO-2	**Bisection method**	Relation between operators	Numerical differentiation Examples	Taylor series method	Explicit scheme
S-3	SLO-1	**A solution of numerical equation by Method of false position.**	Differences of a polynomial – Factorial polynomial	Numerical differentiation Examples	Euler's method	Crank-Nicholson scheme
	SLO-2	**False position method.**	Newton's interpolation - Newton's forward interpolation for equal intervals	Newton's backward difference formula for derivatives	Euler's method	Stability of the above schemes
S-4	SLO-1	**False position method.**	Newton's forward interpolation for equal intervals	Numerical differentiation Examples	Euler's method	Solution of one dimensional parabolic equation by Explicit scheme
	SLO-2	**A solution of numerical equation by** Fixed point iteration method	Newton's backward interpolation for equal intervals	Numerical differentiation Examples	Improved Euler's method	Solution of one dimensional parabolic equation by Explicit scheme
S-5	SLO-1	Iteration method	Newton's backward interpolation for equal intervals	Numerical differentiation Examples	Improved Euler's method	Solution of one dimensional parabolic equation by Crank-Nicholson scheme
	SLO-2	iteration method	Newton's forward and backward interpolation for equal intervals		Improved Euler's method	Solution of one dimensional parabolic equation by Crank-Nicholson scheme
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

S-7	SLO-1	**A solution of numerical equation by Newton-Raphson method**	Central difference interpolation	Numercal Integration – Trapezoidal rule	Modified Euler's method	One dimensional Hyperbolic equation
	SLO-2	**Newton-Raphson method**	Stirling's formula for interpolation - Examples	Trapezoidal rule	Modified Euler's method	Methodology for solving hyperbolic equation
S-8	SLO-1	**A solution of numerical equation by Newton-Raphson method**	Stirling's formula for interpolation – Examples	Simpson's one-third rule	Modified Euler's method	Finite difference scheme
	SLO-2	**Newton-Raphson method**	Bessel's formula for interpolation – Examples	Simpson's one-third rule	Improved and Modified Euler's method	Solution of hyperbolic equation with finite difference scheme
S-9	SLO-1	Solving system of linear equation by Gauss Elimination method	Bessel's formula for interpolation – Examples	Simpson's three-eigth rule	Improved and Modified Euler's method	Examples with various boundary conditions
	SLO-2	Gauss Elimination method	Divided differences and Properties	Simpson's three-eigth rule	Improved and Modified Euler's method	Examples with various boundary conditions
S-10	SLO-1	Gauss Elimination method	Interpolation with unequal intervals by newton's divided difference	Gaussian quadratures	**Examples**	Examples with various boundary conditions
	SLO-2	Solving system of linear equation by Gauss Jordan method	Newton's divided difference formula for unequal intervals	Gaussian quadratures	Examples	Examples with various boundary conditions
S-11	SLO-1	Gauss Jordan method	Interpolation for unequal intervals	Gaussian quadratures	**Runge kutta method of fourth order**	Practice problems
	SLO-2	Gauss Jordan method	Interpolation for unequal intervals	Gaussian quadratures	Examples	Practice problems
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Solving system of linear equation by Crout's method	Lagrange's interpolation formula for unequal intervals	Best Approximations -	**Runge kutta method of fourth order**	Elliptic equations
	SLO-2	Crout's method	Lagrange's interpolation formula for unequal intervals	Least squares polynomial approximation	**Runge kutta method of fourth order**	Finite difference scheme
S-14	SLO-1	Crout's method	Lagrange's interpolation formula for unequal intervals	Least squares polynomial approximation	**Runge kutta method of fourth order**	Mesh points
	SLO-2	Solving system of linear equation by Gauss Jacobi iterative method	Inverse interpolation– Lagrange's formula for inverse interpolation	Least squares polynomial approximation	Multi step methods	Diagonal five point finite difference formula
S-15	SLO-1	Gauss Jacobi iterative method	Lagrange's formula for inverse interpolation	**Approximation with Chebyshev polynomials**	**Milne's method**	Standard five point finite difference formula
	SLO-2	Gauss Jacobi iterative method	Lagrange's formula for inverse interpolation	**Chebyshev polynomials**	**Milne's method**	Solution of elliptic equation using finite difference scheme
S-16	SLO-1	Solving system of linear equation by Gauss seidal iterative method	Spline Interpolation	**Chebyshev polynomials**	**Milne's method**	Solution of elliptic equation using finite difference scheme
	SLO-2	Gauss seidal iterative method	Cubic Spline interpolation	Piecewise Linear & Cubic spline approximation	Adams Bashforth method	Examples on different regions with various boundary values
S-17	SLO-1	Gauss seidal iterative method	Spline Interpolation	Cubic spline approximation	Adams Bashforth method	Examples on different regions with various boundary values
	SLO-2	Solving system of linear equation by Gauss Jacobi and seidal iterative method	Cubic Spline interpolation	Cubic spline approximation	Adams Bashforth method	Revision
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Kandasamy P, Thilagavathy. K and G. Gunawathy, Numerical Methods, S.Chand & Sons, 3rd Revised Edition, 2013. 2. Isaacson E. and Keller, H.B., "Analysis of Numerical Methods" Dover Publication, 1994. 3. Philips G.M and Taylor P.J., "Theory and Applications of Numerical Analysis", Academic Press, 1996. 4. 3. Jain M.K, "Numerical Methods for Scientific and Engineering computation", 3rd Edition, New Age International, 1999. 5. Conte S.D. and Carl de Boor, "Elementary Numerical Analysis", 3rd Edition, Tata McGraw-Hill Publishing Company. 2004. 6. Atkinson K.E., "An Introduction to Numerical Analysis", Wiley & Sons, 2nd Edition, 1989. 7. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson. 8. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole. 9. F. B. Hildebrand (2013). Introduction to Numerical Analysis: (2nd edition). Dover Publications. 10. Balagurusamy. E, Numerical Methods, Tata Mcgraw Hill Publishing Company, 3rd Edition, 2000.

Learning Assessment											
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		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs. T. Leelavathy, SRMIST

Course Code	UCD20S01L	Course Name	Soft Skills	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre		Data Book / Codes/Standards	-	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Expose students to right attitudinal and behavioral aspects and to build the same through activities
CLR-2 :	Develop and nurture interpersonal skills of the students through individual and group activities.
CLR-3 :	Increase efficiency and leadership skills and to improve team results.
CLR-4 :	Acquire time management skills and develop creative skills
CLR-5 :	Understand intercultural communication and etiquettes required in a professional environment
CLR-6 :	Instill confidence in students and develop skills necessary to face the challenges of competitive exams and placements

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Re-engineer their attitude and understand its influence on behavior	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-2 :	Acquire inter personal skills and be an effective goal oriented team player	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-3 :	Understand the importance of time management and creativity	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-4 :	Build confidence during any presentation	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-5 :	Develop interpretation skills and intercultural communication	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-6 :	Help the students succeed in competitive exams and placements	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	IKIGAI	Interpersonal Skills	Creating brands – activity (posters, flyers, business cards)	Value of Time	Intercultural communication – beliefs, customs and attitude of people in different countries (US, UK, Japan, West Asia, China, Russia)
	SLO-2	IKIGAI	Emotional Intelligence	Creating brands – activity (posters, flyers, business cards)	Diagnosing Time Management	Social and cultural etiquettes
S-2	SLO-1	Attitude	Importance of Team Work	Causes of Stress and Its Impact	Weekly Planner, To do list, Prioritizing work	Communication etiquettes
	SLO-2	Factors influencing Attitude	Team Building Activity	How to Manage Stress and Distress?	Time management activity	Telephone etiquettes
S-3	SLO-1	SWOT Analysis	Leadership skills	Understanding the Circle of Control	Creativity – think out of the box	Dinning etiquettes
	SLO-2	Individual SWOT Analysis – activity	Leadership skills based Activity	Stress Busters	Creativity Activity	Grooming etiquettes
S-4	SLO-1	Extempore Practice Session	Networking skills	Conflicts in Human Relations – reasons	Creativity Assessment Activity	Ice breaking
	SLO-2	Extempore Practice Session	Networking skills based Activity	Approaches to conflict resolution	Creativity Assessment Activity	Designing ice breaker games
S-5	SLO-1	Extempore Practice Session	Negotiation skills	Conflict resolution – case studies	Brainstorming, use of groups and individual brainstorming techniques to promote idea generation	Ice breaker activity
	SLO-2	Extempore Practice Session	Negotiation skills based Activity	Conflict resolution – case studies	Brainstorming session activities	Ice breaker activity
S-6	SLO-1	Extempore Practice Session	Entrepreneurial Skills	Importance and necessity of Decision Making	Brainstorming session	Introduction to resume building
	SLO-2	Extempore Practice Session	Entrepreneurial knowledge, Focus, Investment, Risk tolerance, Resilience, Negotiation, Ethics, Networking	Process of Decision Making, Practical Way of Decision Making, Weighing Positives and Negatives	Brainstorming session	Introduction to resume building

Learning Resources	1. *Jeff Butterfield, Soft Skills for Everyone, CENGAGE, India, 2015* 2. *Dr. K. Alex, Soft Skills, S.Chand Publishing & Company, India, 2014* 3. *Covey Sean, Seven habits of highly effective teens, Simon & Schuster, New York, 2014*	*4. Carnegie Dale, How to win friends and influence people, Simon and Schuster, New York, 2016* *5. Thomas A Harris, I am ok, you are ok, Arrow, London, 2012* *6. Daniel Coleman , Emotional Intelligence , Bloomsbury, India, 2016*

Learning Assessment					
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**			
		CLA-1 (20%)	**CLA-2 (20%)**	**CLA-3 (30%) #**	**CLA-4 (30%)##**
		Practice	**Practice**	**Practice**	**Practice**
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.
CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Ajay Zener, Director, Career Launcher	-	*1. Mr Priyanand, Assistant Professor, CDC, E&T, SRMIST*
		2. Ms Sindhu Thomas, Head in charge, CDC, FSH, SRMIST
		3. Ms Mahalakshmi, Assistant Professor, CDC, FSH, SRMIST

Course Code	ULT20G02J	Course Name	Tamil-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	*To generate in students a sensitivity to gender marginalization and Eco sensitivity.*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2:	*An evolved consciousness in the minds to accommodate all is developed*																		
CLR-3:	*The ability to accept all and to co- exist is initiated*																		
CLR-4:	*To create community connectivity and interdependence is initiated*																		
CLR-5:	*To instill language skills*																		
CLR-6:	*To give them all the historical insights*																		
CLO-1:	*To acquire knowledge about Tamil Language*	2	75	60	H	H	H	-	-	H	H	H	H	H	H	H	H	H	H
CLO-2:	*To strengthen the knowledge on concept, culture, civilization and translation of Tamil*	2	80	70	-	H	-	H	H	H	H	-	-	H	H	H	H	H	H
CLO-3:	*To develop content using the features in Tamil language*	2	70	65	H	-	-	H	-	H	H	H	-	H	H	H	H	H	H
CLO-4:	*To use Tamil Language and Literature to enhance their creativity*	2	70	70	H	-	H	M	H	-	-	-	H	H	H	H	H	H	H
CLO-5:	*To improve communication and creative expression in Tamil language*	2	80	70	-	H	-	H	-	H	H	-	-	H	H	H	H	H	H
CLO-6:	To enable the students to speak and write in chaste Tamil	2	75	70	H	H	H	H-	H	H	H	H	H	H	H	H	H	H	H

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	தமிழில் காலந்தோறும் அகமரபு	களப்பிரர் காலம்	பல்லவர் காலம்	சங்ககால வரலாறு	தமிழ்ச் சிறுகதைப் போக்குகள்
	SLO-2	அக இலக்கியப் போக்குகள்	அறமும் வாழ்வியலும்	பல்லவர் கால இலக்கியம்	சங்ககால மக்களின் வாழ்வியல்	தமிழ்ச் சிறுகதையும் தமிழ்ச் சமூக வாழ்வியலும்
S-2	SLO-1	எட்டுத்தொகை நூல்களும் பெயர்களும்	திருக்குறள் - உலகப்பொதுமறை	பக்தியும் தமிழும்	முச்சங்கம் – அறிமுகம்	புதுமைப்பித்தன் - அகல்யை
	SLO-2	எட்டுத்தொகையில் அக நூல்கள்	திருக்குறள் கட்டமைப்பு	பக்தி இலக்கியங்கள்	முச்சங்க வரலாறு	தொன்மம் – கட்டுடைப்பு
S-3	SLO-1	ஐங்குறுநூறு (203)	தமிழில் வினை	சைவ சமய இலக்கியங்கள்	செம்மொழி இலக்கியங்கள்	அகிலன் - ஒருவேளைச் சோறு
	SLO-2	தலைவனின் நாட்டுப் பெருமை	திருக்குறள் - வினைத்திட்பம் (67)	தேவார மூவர்	பாட்டும் தொகையும்	தொழிற்புரட்சியும் விவசாயமும்
S-4	SLO-1	குறுந்தொகை (130)	உழவும் தமிழர் வாழ்வும்	தேவாரம் – திருஞான சம்பந்தர் பாடல்	எட்டுத்தொகை உருவாக்கப் பின்புலம்	ஆண்டாள் பிரியதர்ஷினி – மாத்திரை
	SLO-2	அகவாழ்வில் நம்பிக்கை வேர்கள்	திருக்குறள் - உழவு (104)	தேவாரம் – திருநாவுக்கரசர் பாடல்	எட்டுத்தொகையும் தமிழர் வாழ்வியலும்	குடும்பம் – கட்டமைப்பு
S-5	SLO-1	பண்டைத் தமிழரின் வாழ்வியல்	சமண சமய இலக்கியங்கள்	திருவாசகம் அறிமுகம்	பத்துப்பாட்டு உருவாக்கப் பின்புலம்	பாரததேவி - மாப்பிள்ளை விருந்து
	SLO-2	பண்டைத் தமிழர் உணர்வியல்	நாலடியார்	மாணிக்கவாசகர் பாடல்	பத்துப்பாட்டும் தமிழர் வாழ்வியலும்	எளிய மனிதர்களின் கதை
S-6	SLO-1	அகநானூறு (44)	இலக்கியங்களில் நட்பு	வைணவ சமய வளர்ச்சிப் போக்கு	பதினெண் கீழ்க்கணக்கு நூல்கள்	சிங்கார வடிவேலு – தவிப்பு

	SLO-2	புறவாழ்வோடு கூடிய அகம்	நட்பில் பிழை பொறுத்தல் (221)	வைணவ சமய இலக்கியங்கள்	பதினெண் கீழ்க்கணக்கும் தமிழர் அற மரபும்	புறக்கணிப்பின் வலி
S-7	SLO-1	கற்றறிந்தார் ஏத்தும் கலி	தமிழர் மருத்துவம்	நாலாயிரத் திவ்யப் பிரபந்தம்	நீதி இலக்கியங்கள்	செய்தி அறிக்கை அறிமுகம்
	SLO-2	கலித்தொகை கட்டமைப்பு	நீதி இலக்கியத்தில் மருத்துவ நூல்கள்	பெரியாழ்வார் பாடல்	நீதி இலக்கியங்களின் பன்முகத் தன்மைகள்	செய்தி அறிக்கை தயாரித்தல்
S-8	SLO-1	கலித்தொகை (149)	திரிகடுகம்	ஆண்டாள் பாடல்	காப்பிய இலக்கணம்	விமர்சனம்
	SLO-2	வாழ்வியல் அறமும் அகமும்	செங்கோல் அரசு	தொண்டரடிப்பொடி ஆழ்வார் பாடல்	காப்பியப் போக்குகள்	இலக்கியம், கலை விமர்சனம்
S-9	SLO-1	தமிழர் புறமரபு	இனியவை நாற்பது அறிமுகம்	தமிழில் இஸ்லாமிய இலக்கியங்கள்	ஐம்பெருங்காப்பியங்கள்	நேர்காணல் அறிமுகம்
	SLO-2	புற இலக்கியங்கள்	இனியவை நாற்பதின் தனித்தன்மைகள்	இஸ்லாமிய இலக்கியங்களின் கொடை	ஐம்பெருங்காப்பியங்களின் சிறப்புகள்	நேர்காணல் – நுட்பங்கள்
S-10	SLO-1	புறநானூறு (235)	இனியவை நாற்பது (14)	சீறாப்புராணம்	தமிழ்ச் சமூகமும் சமயத் தத்துவங்களும்	நேர்காணல் கேள்வி தயாரிப்பு
	SLO-2	கையறுநிலை	இனிமையும் அழகும்	மானுக்குப் பிணைநின்ற படலம் (5 பாடல்கள்)	சமயத் தத்துவங்களும் வாழ்வியல் விழுமியங்களும்	நேர்காணல் பதிவும் எழுது முறையும்
S-11	SLO-1	ஆற்றுப்படை அறிமுகம்	பண்டைக்காலப் போரும் வாழ்வும்	கிறித்தவ சமய இலக்கியங்கள்	பன்னிரு திருமுறை – அறிமுகம்	பேச்சுக்கலை அறிமுகம்
	SLO-2	ஆற்றுப்படை மரபுகள்	போர் இலக்கியங்கள்	கிறித்தவ இலக்கியங்களின் கொடை	பன்னிரு திருமுறை – வரலாறு	தமிழரின் பேச்சுக்கலை
S-12	SLO-1	சிறுபாணாற்றுப் படை	களவழி நாற்பது (14)	ஆதிநந்தாவனப் பிரளயம்	நாலாயிரத் திவ்யப் பிரபந்தம் – அறிமுகம்	பேச்சுக்கலையின் வகைகள்
	SLO-2	நல்லியக்கோடனும்பாணர் வாழ்வியலும்	தமிழர் வீரம்	ஏதேன் தோட்ட வருணனை	பன்னிரு ஆழ்வார்கள் வரலாறு	பேச்சுப் பயிற்சி

Learning Resources	1. மௌவல், தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள், தமிழ்த்துறை, எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம், காட்டாங்குளத்தூர், **603203, 2020.** 2. தமிழண்ணல், புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தக நிலையம், மதுரை, 2017 3. மு. அருணாசலம், தமிழ் இலக்கிய வரலாறு, நூற்றாண்டு முறை (9ஆம் நூ. முதல் 16 வரை), தி பார்க்கர், சென்னை, 2005 4. தமிழ் இணையக் கல்விக்கழகம் - **http://www.tamilvu.org/** 5. மதுரை தமிழ் இலக்கிய மின் தொகுப்புத் திட்டம் - **https://www.projectmadurai.org/**

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. R..Srinivasan, Associate Professor, Department of Tamil, Presidency College, Chennai.	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*
		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

Course Code	ULH20G02J	Course Name	HINDI-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*HINDI*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*To be able to converse well in the Hindi Language*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	*To read and write and clarity*																		
CLR-3 :	*To be willing listeners and translators –where need be*																		
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*																		
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*																		
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*																		
CLO-1 :	*To acquire knowledge about Medieval and Modern Poetry.*	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To consider the relevance of the present trends in Hindi and their contemporary relevance.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To help develop better understanding of the Hindi language by studying the stories with reference to current reality.*	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To understand the usage of the present Advertising trends and its creative angles with the varied skills of Hindi Language.*	2	70	70	H	-	H	H	H	-	-	-	-	-	H	-	-	-	-
CLO-5 :	*To make translation of good literature and any relevant document from the Hindi Language to English and Vice-versa.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*To help the learner to tackle Administrative terminologies, help them use Idioms and Phrases in their daily life, with ease.*	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Kavye ke guno se awagat karana - Jaysi	Kahani Idkiyan	VIGYAPAN	ANUVAD	Takniki Shabdavali
	SLO-2	Ishk hakiki evam moksh bhava se awagat karana	Nari Shakti ki sarthakata	Srijnatamak kshmata jagrit karna	Vidhyarthiyon ko sikhaya jayega anuvad kitna upyogi hai	Vaignik tarike se bhashaon ka avishkaar karna
S-2	SLO-1	Surdas – Vatsalya ras se awagat karana	Kahani gunda Prem ki prakashtha se awagat karvana	VIGYAPAN KYA HAI	ARTH	ARTH
	SLO-2	Bhakti Bhavna se vidhyarthiyon ko jodna	Prtantr bharat ki samajik vyavstha se awagat karvana	Shabdavali evam chitratamakta se awagat karvana	Vidhyarthiyon dwara arth smajkar samaj ke liye mahtavpurn karya kar payenge	Vidhyarthi uske arth dwara hi uske mahtav smjhenge
S-3	SLO-1	Tulsidas-Manav mulyon ki prabal bhavna jagrit karna	KAHANI KE TATVA	VIGYAPAN KI BHASHA	PARIBHASHA	PARIBHASHA
	SLO-2	Dharmik Parvarti se awagat karana	Kahani ke tatva ki mahatta se awagat karvana	Bhasha ki abhivyakti ke pryog ko smjhana	Vibhinn vidwano dwara di gai paribhasha se us baat ko smjhenge vidhyathi	Vibhinn vidwano dwara di gai paribhasha se us baat ko smjhenge vidhyathi
S-4	SLO-1	Tiruvaluvaar – naitik mulyon ko jagrit karna	KAHANI KE AAYAM	VIGYAPAN KA PRBHAV	MAHATVA	SHABDAVALI KI AVSHYAKTA
	SLO-2	Vidhyarthiyon ko nitivaan bnana	Vidhyarthiyon ko kahani ke vidhinn ayam se awagat karvana	Shravaya-drishya samgri ke prbhav ki upyogita	Samijik jan-jeevan ke liye anuvad ke mahtav ko smjhana.	Vaignikon ka awiskar kitna mahtavpurn
S-5	SLO-1	Desh prem ki bhavna bharna	LEKHAK PARICHAY	VIGYAPAN AUR BAZAR	UDDESHYA	BHASHA VAIGYANIK
	SLO-2	Krantikari vicharon se Awagat karana	Lekhako ke jivan se awagat karvana	Vidhyarthioyon ko vigyapan se bazar me kaise sthapit kiya ja skata hai batana	Vidhyarthi anuvad ke uddeshya ko smajhkar samaj upyogi karya krne me apni sarthak bhumika nibhayenge	Bhasha vaignikon ki jankari
S-6	SLO-1	Badal Raag- Desh prem ki bhavna bhrna	KAHANI PATH	VIGYAPAN AUR ROZGAR	HINDI-ENGLISH	KARYALYIN SHABD
	SLO-2	Krantikari vicharo se awagat karana	Vidhyarthiyon ko kahani path ke dwara unka vak kausal majbut karna	Vidhyarthi savam ka ad-ajency bhi bna paye	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna	Shabd kaise tayar kiye jate hain vidhyorthiyon ko jankari

S-7	**SLO-1**	Pret ka Byaan -Bhukhmari evam akaal se awagat karana	KAHANI KA SARANSH	VIGYAPAN KI NIYAM	ENGLISH-HINDI	ANGREZI SE HINDI ANUVAD
	SLO-2	Samajik samanta banaye rkhne ki pravarti jagana	Lekhan kshmata ka vikas hona	Vigyapan ka ek hi niyam bhasha ka kashav jo vidhyarthiyon me viksit kiya jayega	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna
S-8	**SLO-1**	Lahro se dark a nauka paar nhi hoti –chatro ko sahashi bnana	KAHANI KA UDDESHYA	VIGYAPAN KA MAHTVA	ANUVAD KI UPYOGITA	HINDI SE ANGREZI ANUVAD
	SLO-2	Karmaththa purn bhavna ko jagrit karna	Kahani ke uddeshy unke jiwan ke mahtav ko smjhne me sahayk banna	Vartman me uski prasangikta vidhyarthiyon ko smjhana	Vidhyarthiyon ko vibhin karyalayon me hindi adhikari pad ki jankari prapt	Hindi adhikari aur anuvadak ke pad ke liye tayaar karna.
S-9	**SLO-1**	Javani –rashtr prem ki bhavna jagrit karna	KAHANI KA VISHELESHAN	PRINT VIGYAPAN	ANUVADk KI BHUMIKA	EK DIN EK SHABD
	SLO-2	Vir ras evam virta ki pravati se awagat karana	Vishleshan kshmata viksit hota	Vidhyarthi iski bhasha sikhenge	Vidhyarthiyon ko anuvadak ki bhumika ka mahtav smajh aayega jiske adhar par vo kaam karenge	Vidhyarthiyon ko rozgaar se jodna
S-10	**SLO-1**	Dhool- saman vyavhar ki pravarti jagana	KAHANI PARICHARCHA	RADIO, TV.VIGYAPAN	SAHITYIK ANUVAD	PRYOJANMULAK SHABD KA MAHTAVA
	SLO-2	Satah se jude rahne ke prerna dena.	Vaad-vivad se vidhyarthiyon me apni baat ko rkhne ki yogyata banna	Vidhyarthiyon ko abhyas karvaya jayega	Vibhinn bhashaon ke sahitya ka anuvad kaise kiya jane ki chunouti ko samjajh payenge	Vidhyarthiyon ko vaighniko dwara tayaar ki gai bhasha ki samaj
S-11	**SLO-1**	KAVYA BIBM	KAHANI ANDOLAN	Ad agency	ANUVAD KE NIYAM	VIBHINN KSHETRO ME PRYOJANMULAK SHABDO KA MAHATAV
	SLO-2	Vidhyarthiyon ko naye-naye bibm ki jankari prapt hona	Vibhinn kahani andolan se bhi awagat karana	Ad agency aur swarozgaar se jodna	Anuvad ke niyamo ko vidhyarthi smajh payenge	Hindi adhikari pad par karyarat
S-12	**SLO-1**	SAMUHIK PARICHARCHA	KAHANI KA BADLTA SWAROOP	VIGYAPAN KA SWARUP	SHABDO KA MAHATAV	VAIGYANIK SHABDAVALI KI AVSHYAKATA
	SLO-2	Vidhyarthiyon ki bolne ki kaushal kshamta ko bdhana	Smay ke sath unke swarup ke bdlav ka bhi vidyarthi me samajh paida hona	Vidhyarthiyon ko vigyapan lekha ki barikayon ki samajh utpann hona	Shabda anuvad ke mahtva ko vidhyarthi smajhenge	Vidhyarthiyon ko shabdo ki vaignikta se jodna

Learning Resources	***The Prescribe Text Book Compiled and Edited by Department of Hindi*** *www.kavitakosh.org* *www.shabdkosh.com*

Learning Assessment

	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

Course Code	ULF20G02J	Course Name	French-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Strengthen the language of the students both in oral and written	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	Express their sentiments, emotions and opinions, reacting to information, situations																		
CLR-3 :	Make them learn the basic rules of French Grammar.																		
CLR-4 :	Develop strategies of comprehension of texts of different origin																		
CLR-5 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French																		
CLR-6 :	*Extend and expand their savoir-faire through the acquisition of current scenario*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To acquire knowledge about French language*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*M*	*-*	*-*	*-*	*-*
CLO-3 :	*To develop content using the features in French language*	*2*	*70*	*65*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-4 :	*To interpret the French language into other language*	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-6 :	To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	*2*	*75*	*70*	*H*	*-*	*M-*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	**Les loisirs**	**La routine**	**Où faire ses courses ?**	**Découvrez et dégustez**	**Tout le monde s'amuse**
	SLO-2	**Les activités**	**Les exemples**	**Les courses**	**Dégustez**	**Le monde**
S-2	SLO-1	Les activités quotidiennes	Les adjectifs interrogatifs	Les aliments	Les articles partitifs	Les sorties
	SLO-2	Les quotidiennes	Les trois formes	Les exemples	Du, De la, De l', Des	Les exemples
S-3	SLO-1	Les matières	Les nombres ordinaux	Les quantités	Le pronom en (la quantité)	Situer dans le temps
	SLO-2	Les exemples	Les nombres	Les exemples	Le bon quantité	Les activités
S-4	SLO-1	Le temps	L'heure	Les commerces	Très ?	Les vêtements
	SLO-2	L'heure	Quelle heure est-il ?	Les activités	Beaucoup ?	Les accessoires
S-5	SLO-1	Les fréquences	Le pronom personnel COD	Les commerçants	La phrase négative (2)	**Les ados au quotidien**
	SLO-2	Les activités	Les exemples	Les exemples	Les négations	**La vie quotidienne**
S-6	SLO-1	Les sons [u]	Les pronominaux	Demander le prix	C'est /Il est	Les adjectifs démonstratifs
	SLO-2	Les sons [y]	Se promener, se coucher etc…,	Dire le prix	Les activités	Ce, Cet, Cette, Ces
S-7	SLO-1	Les loisirs	Les verbes du premier groupe	Les services	L'impératif	La formation du féminin
	SLO-2	Les exemples	Parler, Demander, Poser	Les exemples	Les exemples	Les exemples
S-8	SLO-1	La routine	groupe en –e_er,é_er,-eler,-eter	Les moyens de paiement	Les verbes devoir, pouvoir	Le pronom indéfini on
	SLO-2	Les activités	Appeler, Jeter etc..,	La carte de crédits	Les verbes savoir, vouloir	Les activités
S-9	SLO-1	Les Mots	Le verbe prendre	les sons [ã]	Il faut	Le futur proche
	SLO-2	Les expressions	Les exemples	Les sons [an]	Le verbe impersonnel	S+Aller+Infinitif du verbe
S-10	SLO-1	Exprimer ses gouts	Parler de ses gouts	Découvrez !	Au restaurant : Commander et commenter	Le passe composé

	SLO-2	Les exemples	Des gouter	Dégustez !	Les restaurant	Les exemples
S-11	**SLO-1**	Exprimer ses préférences	Parler de ses préférences	Au restaurant : commander	Inviter à une invitation	Les verbes voir et sortir
	SLO-2	Les activités	Les exemples	Au restaurant : commenter	Répondre à une invitation	Décrire une tenue
S-12	**SLO-1**	Décrire sa journée	Décrire sa journée	Inviter à une invitation	Les Mots	écrire un message amical
	SLO-2	Les exemples	Les activités	Répondre à une invitation	Les expressions	Lire un message

Learning Resources	***Theory:*** 1. ''**Génération-AI''** Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018. ***2.Cahier d'activités avec deux discs compacts.***

Learning Assesment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

Course Code	UMA20201T	Course Name	DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR)	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-	To understand the concepts of first order differential equations.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-	To learn the concepts of ODEs by different methods.																		
CLR-	To know how to solve differential equations of Lagrange's type.																		
CLR-	To learn the concepts of the method of multipliers.																		
CLR-	To learn the different types of Laplace transform and properties.																		
CLR-	To understand the evaluation of inverse Laplace transforms.																		
Course Learning Outcomes	At the end of this course, learners will be able to:																		
CLO-	Analyzing the second order differential equations.	2	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-	Examine sound Knowledge in mappings of ODE.	2	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-	Calculate the several facts on testing of Lagrange's.	2	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-	To apply the method of multipliers.	2	85	80	H	H		M	-	-	-	-	M		-	H	-	-	-
CLO-	Illustrate the periodic function.	2	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-	To know the applications of Laplace transform.	2	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to differential	Introduction to differential equation	Introduction to simultaneous	Introduction to Laplace transform	Initial value theorem
	SLO-2	Introduction to differential	Applications of differential equation	Applications of simultaneous	Applications and properties	Problems in initial value theorem
S-2	SLO-1	Applications of Differential	Complementary function	Simultaneous differential equation	Linearity property	Problems in initial value theorem
	SLO-2	Applications of Differential	Problems based on complementary	Problems in Simultaneous	Problems based on Linearity property	Problems in initial value theorem
S-3	SLO-1	Problems in differential	Particular Integral	Linear differential equations with	First shifting property	Final value theorem
	SLO-2	Problems in differential	Problems in Particular Integral	Problems in Cauchy's homogeneous linear	Problems in First shifting property	Problems in final value theorem
S-4	SLO-1	Type I – Solvable for p	Particular Integral - Type I : e^{ax}	Method of reduction of order	Change of scale of property	Laplace transform: Residue theorem
	SLO-2	Type I – Solvable for p	Problems in Particular Integral -	Problems in method of reduction of order	Problems in Change of scale of property	Laplace transform: Residue theorem
S-5	SLO-1	Equation solvable for p	Particular Integral - Type II : $\sin ax$ or	Transformation of the equation by changing	Laplace transform of derivatives	Problems on Residue theorem
	SLO-2	Equation solvable for p	Problems in Particular Integral -	Problem in Transformation of the	Problems in Laplace transform of derivatives	Problems on Residue theorem
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Problems in solvable for p	Particular Integral - Type III : x^n	Reduction to canonical (or) normal	Laplace transform of integrals	Laplace transform - Convolution theorem
	SLO-2	Problems in solvable for p	Problems in Particular Integral -	Problems based on Reduction to	Problems in Laplace transform of integrals	Laplace transform - Convolution theorem
S-8	SLO-1	Type II – Solvable for y	Particular Integral – Type IV : $e^{ax} f(x)$	Special types of equations	Laplace transform of periodic function	Problem based on Convolution theorem
	SLO-2	Type II – Solvable for y	Problems in Particular Integral -	Application of special types of equations	Laplace transform of periodic function	Problem based on Convolution theorem
S-9	SLO-1	Equations solvable for y	Particular Integral – Type V : $x^n \sin ax$ or $x^n \cos$	Special types of equations Type I : $f\left(x, \frac{dy}{dx}\right)$	Problems in periodic function	Laplace transform – Partial fractions
	SLO-2	Equations solvable for y	Problems in Particular Integral $x^n \sin ax$ or $x^n \cos$	Special types of equations Type I : $f\left(x, \frac{dy}{dx}\right)$	Problems in periodic function	Laplace transform – Partial fractions
S-10	SLO-1	Problems in solvable for y	Particular Integral – Type VI : $x f(x)$	Problems based on $f\left(x, \frac{dy}{dx}\right)$	Inverse Laplace Transform	Problem based on Laplace transform – partial fractions
	SLO-2	Problems in solvable for y	Problems in Particular Integral Type VI : $x f(x)$	Problems based on $f\left(x, \frac{dy}{dx}\right)$	Applications of Inverse Laplace Transform	Problem based on Laplace transform – partial fractions

S-11	SLO-1	Type III – Solvable for x	Problems based on the particular integral	Special types of equations Type II : $f\left(y, \frac{dy}{dx}\right)$	Inverse Laplace Transform – Linearity property	Application of Laplace transform to solve differential equations
	SLO-2	Type III – Solvable for x	Problems based on the particular integral	Special types of equations Type II : $f\left(y, \frac{dy}{dx}\right)$	Problems in Inverse Laplace Transform – Linearity property	Application of Laplace transform to solve differential equations
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Equations solvable for x	Linear differential equations with	Problems in: $f\left(y, \frac{dy}{dx}\right)$	Inverse Laplace Transform – first shifting property	Problems in Laplace transform to solve differential equations
	SLO-2	Equations solvable for x	Problem in Linear differential	Problems in: $f\left(y, \frac{dy}{dx}\right)$	Problems in Inverse Laplace Transform – first shifting	Problems in Laplace transform to solve differential equations
S-14	SLO-1	Problems in solvable for x	Linear differential equations with	Equations $f(x, y, y', y'') = 0$	Inverse Laplace Transform – change of scale property	Laplace transform simultaneous linear differential equation
	SLO-2	Problems in solvable for x	Problem in Linear differential	Equations $f(x, y, y', y'') = 0$	Problems in Inverse Laplace Transform – change of scale	Laplace transform simultaneous linear differential equation
S-15	SLO-1	Type IV – Clairaut's	Method of variation of parameters	Problems in equations	Inverse Laplace Transform of derivatives	Problems in simultaneous linear differential equation
	SLO-2	Type IV – Clairaut's	Applications of Method of variation	Problems in equations	Problems in Inverse Laplace Transform of derivatives	Problems in simultaneous linear differential equation
S-16	SLO-1	Problems based on Clairaut's	Problems in Method of variation of parameters	Solution of the equation $\frac{dy}{dx} + Py + Q$	Inverse Laplace Transform of integrals	Solution of differential and integral equations
	SLO-2	Problems based on Clairaut's	Problems in Method of variation of parameters	Solution of the equation $\frac{dy}{dx} + Py + Q$	Problems in Inverse Laplace Transform of integrals	Solution of differential and integral equations
S-17	SLO-1	Problems in Clairaut's	Problems in Method of variation of	Problems in $\frac{dy}{dx} + Py + Q$	Problems based on inverse Laplace transform	Problems in Solution of differential and integral equations
	SLO-2	Problems in Clairaut's	Problems in Method of variation of	Problems in $\frac{dy}{dx} + Py + Q$	Problems based on inverse Laplace transform	Problems in Solution of differential and integral equations
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. T.Veerarajan, Engineering Mathematics – II, MC-Graw Hill Education(India) Private Limited, 2014. Chapter 1: Section 1.10 – 1.13; Chapter 2: Section 2.1-2.3, 2.4, 2.7; Chapter 3: Section 3.1 – 3.6; Chapter 3: Section 3.9, 3.10, 3.11. 2. T.Veerarajan, Transforms and Partial Differential Equations, Third Edition, MC-Graw Hill Education(India) Private Limited, 2016. 3. J.N.Sharma, Kehar Singh, Partial Differential Equations for Engineers and Scientistics, Narosa Publishing house, New Delhi, 2000.	4. Narayanan, T.K. Manickavasagam Pillai, Calculus, Vol. I, S. Viswanathan Printers Pvt. Limited, 2007. 5. K. Thilagavathy, Mathematics for B. Sc Branch – I, Volume 3, 1st Edition, S. Chand and Co.Ltd., New Delhi, 2004. 6. B.S.Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publications. 2012.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. B. Vennila, SRMIST Dr. V. Poongothai, SRMIST

Course Code	UMA20202T	Course Name	CALCULUS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn n^{th} derivative of product of two functions and understand the concept of partial derivatives of homogeneous functions	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To understand the concept of extreme values of functions involving two and three variables																		
CLR-3 :	Learn the concept of integration by means of various methods																		
CLR-4 :	Study in detail the topic on definite integrals as well as reduction formulae																		
CLR-5 :	Apply the geometrical applications of integration																		
CLR-6 :	Apply the concept of integration in area and volume																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Know the fundamental application of partial derivatives	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Identify the extremum of a function with two and three variables	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Understand the concept of different methods of solving integrals	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Apply the reduction formula to evaluate the given integral.	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Associate the rule of integration in finding length and area of a curve	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solve multiple integrals	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to Differential Calculus	Introduction to Maxima and Minima function of two variables	Introduction to Integration	Introduction to definite integral	Introduction to geometrical applications of integration
	SLO-2	Limits and Continuity	Introduction to Maxima and Minima function of two variables	Introduction to Integration	Definition of definite integral	Introduction to geometrical applications of integration
S-2	SLO-1	Continuity of Functions, Graphical meaning of Continuiity	Working rule to find Maxima and minima	**Methods of Integration**	Rule to find $\int_a^b f(x)dx$	Areas in polar coordinates
	SLO-2	**Differentiation of inverse functions, hyperbolic and inverse hyperbolic function**	Working rule to find Maxima and Minima	Method of Integration-Substitution method	Properties of definite integrals	Formula to find areas in polar coordinates
S-3	SLO-1	Function of function rule	Problems in Maxima and Minima	Method of Integration-Substitution method	Properties of definite integrals	Problems in areas in polar coordinates
	SLO-2	Function of logarithmic differentiation	Problems in Maxima and Minima	Method of Integration-Substitution method	Problems in properties of definite integrals	Problems in areas in polar coordinates
S-4	SLO-1	Differentiation of implicit function	Problems in Maxima and Minima	Method of Integration-Substitution method	Problems in properties of definite integrals	Problems in areas in polar coordinates
	SLO-2	Problems in n^{th} derivative	Problems in Maxima and Minima	Method of Integration-Decomposition in to a sum.	**Reduction formulae** $I_n = \int x^n e^{ax} dx$	Problems in areas in polar coordinates
S-5	SLO-1	Problems in n^{th} derivative	Problems in Maxima and Minima	Method of Integration-Decomposition in to a sum.	**Reduction formulae** $I_n = \int x^n e^{ax} dx$	Problems in areas in polar coordinates
	SLO-2	Problems in n^{th} derivative	Problems in Maxima and Minima	Method of Integration-Decomposition in to a sum.	**Reduction formulae** $I_n = \int x^n \cos ax dx$	Problems in areas in polar coordinates
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Formation of equations involving derivatives	Lagrange's method of undetermined multipliers	Method of Integration-Integration by parts	**Reduction formulae** $I_n = \int x^n \cos ax dx$	Length of a curve in Cartesian coordinates
	SLO-2	Formation of equations involving derivatives	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Integration by parts	**Reduction formulae** $I_n = \int x^n \cos ax dx$	Length of a curve in Polar coordinates
S-8	SLO-1	Problems in Leibnitz formula for the n^{th} derivative of a product	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Integration by parts	**Reduction formulae** $I_n = \int \sin^n x dx$	Problems in Length of a curve in Cartesian coordinates
	SLO-2	Problems in Leibnitz formula for the n^{th} derivative of a product	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Integration by parts	**Reduction formulae** $I_n = \int \cos^n x dx$	Problems in Length of a curve in Cartesian coordinates
S-9	SLO-1	Problems in Leibnitz formula for the n^{th} derivative of a product	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Successive reduction	**Reduction formulae** $I_n = \int \cos^n x dx$	Problems in Length of a curve in Cartesian coordinates
	SLO-2	Partial differentiation	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Successive reduction	**Reduction formulae** $I_{m,n} = \int \sin^m x \cos^n x dx$	Problems in Length of a curve in Cartesian coordinates
S-10	SLO-1	Partial differentiation	Problems in Lagrange's method of undetermined multipliers	Method of Integration-Successive reduction	**Reduction formulae** $I_{m,n} = \int \sin^m x \cos^n x dx$	Problems in Length of a curve in Polar coordinates
	SLO-2	Successive partial derivatives - problems	Definition of Envelope	Method of Integration-Successive reduction	**Reduction formulae** $I_n = \int \tan^n x dx$	Problems in Length of a curve in Polar coordinates
S-11	SLO-1	Successive partial derivatives -Problems	Method of finding the Envelope	Method of Integration-Successive reduction	**Reduction formulae** $I_n = \int \tan^n x dx$	Problems in Length of a curve in Polar coordinates
	SLO-2	Successive partial derivatives -Problems	Problems in Envelope	Method of Integration-Successive reduction	**Reduction formulae** $I_n = \int \cot^n x dx$	Problems in Length of a curve in Polar coordinates
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Function of function rule -Problems	Problems in Envelope	Problems in integration by parts	**Reduction formulae** $I_n = \int \cot^n x dx$	Area of surface of revolution
	SLO-2	Function of function rule-problems	Problems in Envelope	Problems in integration by parts	**Reduction formulae** $I_n = \int \sec^n x dx$	Area of surface of revolution
S-14	SLO-1	**Total differential coefficient-problems**	Problems in Envelope	Problems in integration by parts	**Reduction formulae** $I_n = \int \sec^n x dx$	Problems in Area of surface of revolution(Cartesian coordinates)
	SLO-2	Problems in Implicit functions	Problems in Taylor series	Problems in integration by parts	**Reduction formulae** $I_n = \int \sec^n x dx$	Problems in Area of surface of revolution(Cartesian coordinates)
S-15	SLO-1	Problems in Implicit functions	Problems in Taylor series	Problems in Bernoulli's formula	**Reduction formulae** $I_n = \int \operatorname{cosec}^n x dx$	Problems in Area of surface of revolution(Cartesian coordinates)
	SLO-2	Problems in Homogeneous function	Problems in Taylor series	Problems in Bernoulli's formula	**Reduction formulae** $I_n = \int \operatorname{cosec}^n x dx$	Problems in Area of surface of revolution(Cartesian coordinates)
S-16	SLO-1	Problems in Homogeneous function	Problems in Taylor series	Problems in Bernoulli's formula	**Reduction formulae** $I_{m,n} = \int x^m (\log x)^n dx$	Problems in Area of surface of revolution(Polar coordinates)
	SLO-2	Problems in Euler theorem	Problems in Jacobians	Problems in Bernoulli's formula	**Reduction formulae** $I_{m,n} = \int x^m (\log x)^n dx$	Problems in Area of surface of revolution (Polar coordinates)
S-17	SLO-1	Problems in Euler theorem	Problems in Jacobians	Practice problems	**Reduction formulae** $I_n = \int \operatorname{cosec}^n x dx$	Problems in Area of surface of revolution(Polar coordinates)
	SLO-2	Problems in partial differential equation of function of two functions	Problems in Jacobians	Practice problems	Problems involving reduction formula	Problems in Area of surface of revolution (Polar coordinates)
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Calculus, Vol.I, S. Narayanan and T K ManicavachagomPillay, S. Viswanathan Printers and Publishers Pvt. Ltd., 2010. Chapter 3: Sections 1.1 – 1.6, 2.1, 2.2, Chapter 8: Sections 1.1 – 1.6, Chapter 8: Sections 4.1, 5, Chapter 10: Sections 1.1, 1.2, 1.3. 2. CalculusVol. II, S. Narayanan and T K ManicavachagomPillay, S. ViswanathanPrinters and Publishers Pvt. Ltd., 2010. Chapter 1: Sections 5, 6.1 – 6.6, 7.1 – 7.5, 8, 9, 10, 12, 15.1, Chapter 1: Sections 11, 13.1 – 13.10,14,	3. Mathematics,Volume 1, P. Kandasamy and Thilagavathy, S. Chand, New Delhi, 2004. 4. Calculus, Thomas and Finney, Pearson Education, 9th Edition, 2006.

	Chapter 2: Sections 1.4, 4.1, 4.2, 5	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Prof. K. S. Ganapathy Subramanian, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. S. Vidyanandini, SRMIST Mrs. V. Padma

Course Code	UMA20203T	Course Name	Vector calculus, Fourier series and Transforms	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Integral calculus	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Evaluation of double and triple integrals in Cartesian and polar coordinates	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Evaluation of line, surface and volume integrals																		
CLR-3 :	Study of Fourier series expansion in full range																		
CLR-4 :	Study of half range series expansion in cosine and sine																		
CLR-5 :	Study of Fourier transforms and its technique for evaluating integrals																		
CLR-6 :	Study of Fourier sine and Cosine transforms and its technique for evaluating integrals																		
CLO-1 :	Students will be able to evaluate double and triple integrals	1	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Students will be able to evaluate line, surface and volume integrals	2	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Students will be able to expand a given function as a Fourier series in full range	2	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Students will be able to expand a given function as a Fourier cosine and sine series	2	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Students will be able to apply the technique for evaluating integrals using Fourier transform	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Students will be able to apply the technique for evaluating integrals using Convolution	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Course Learning Outcomes (CLO): At the end of this course, learners will be able to:

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Introduction to the concept of integrals	Introduction to Vector Calculus	Introduction to Fourier series	Introduction to Half range Fourier series expansion	Introduction to integral transforms
	SLO-2	Evaluation of integrals	Scalar and Vector Point function	Dirichlet's condition	Sine series expansion over(0,l)	Fourier integral theorem
S-2	SLO-1	Problems in evaluation of integrals	Gradient of the function	Euler constants	sine series expansion over (0,π)	Fourier transform(FT)
	SLO-2	Problems in evaluation of integrals	Finding the grad of a scalar function	Convergence of Fourier series in the interval (a, b)	Sine series for $x-x^2$	FT of $f(x)=1-\|x\|$ in$\|x\|<1$
S-3	SLO-1	Concept of double integrals	Normal vector, unit normal vector	Fourier series expansion over (0,2l)	sine series expansion over(0,l)	FT of $F(x)=1-x^2$ in$\|x\|<1$
	SLO-2	Evaluation of double integrals	Finding the unit normal vector to the given suface	Finding series expansion for cosine and sine function	Sine series expansion for x(1-x)	FT of F(x)=cosx in0<x<1
S-4	SLO-1	Evaluation of double integrals	Angle between the two surfaces	Fourier series expansion over (0,2l)	cosine series expansion over(0,l)	Application Of Inverse fourier transform
	SLO-2	Evaluation of double integrals	Finding the angle between two surfaces at a given point	Finding series expansion for cosine , sine function and polynomials	Problems	FT of $f(x)=a^2-x^2$ in $\|x\|<a$ and hence evaluating some integrals
S-5	SLO-1	Double integrals in polar coordinates	Concept of divergence	Fourier series expansion over (-l, l)	cosine series expansion over(0,l)	FT of $f(x)=a-\|x\|$ in $\|x\|<a$ and hence evaluating some integrals
	SLO-2	Evaluation of double integrals in polar coordinates	Finding the divergence of a vector function	Finding series expansion for even and odd functions	Problems	
S-6	SLO-1	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
	SLO-2	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
S-7	SLO-	Concept of triple integrals	Solenoidal Field	Fourier series expansion of even function over (-l, l)	RMS value of the function in (0,a)	Parseval's identity
	SLO-2	Problems in triple integrals	Problems in solenoidal field	Fourier series expansion of odd function over (-l, l)	Related problems	Related problems
S-8	SLO-1	Problems in triple integrals	Concept of Curl	Fourier series expansion of odd function over (-l, l)	Parseval's identity	Problems on inverse Fourier transform and Parseval's identity

	SLO-2	Problems in triple integrals	Problems in finding the curl of a vector	Problems	Cosine series expansion for $(x-1)^2$	Problems on inverse Fourier transform and Parseval's identity
S-9	SLO-1	Llimit of double integrals for a given region	Irrotational Field	Fourier series expansion of neither even nor odd function over (-l, l)	Parseval's identity	Properties of Fourier transform
	SLO-2	Problems in finding the limits of double integrals	Problems on divergence and curl of vector function	Fourier series expansion of e^{ax} in(-l,l)	Related Problems	Properties of Fourier transform
S-10	SLO-1	Problems in finding the limits of double integrals	Scalar potential function	Problems in full range over (-π, π)	Convergence of Half range series	Problem based on Properties of Fourier transform
	SLO-2	Problems in finding the limits of double integrals	Problems in finding the scalar potential function	Fourier series expansion of e^{ax} in (-π, π)	Related Problems	Problem based on Properties of Fourier transform
S-11	SLO-1	Application of double integrals-Using Cartesian coordinates	Vector integrals	Fourier series expansion over (0, 2π)	Problems in sines with deduction	Fourier sine transform
	SLO-2	Problems in finding the area of a given region	Line integrals	Related Problems	Problems in sines with deduction	Sine transform of e^{ax}
S-10	SLO-1	Problems in finding the area of a region	Problems on Line integrals	Fourier series expansion of even function over (-π,π)	Problems in cosine series with deduction	Inverse Fourier sine transform
	SLO-2	Problems in finding the area of a given region	Problems on Line integrals	Series expansion of $x-x^2$	Problems in cosine series with deduction	Evaluation of integrals
S-11	SLO-1	Problems in finding the area of a given region using polar coordinates	Surface integrals	Fourier series expansion of odd function over (-π,π)	Application of sine series expansion	Inverse Fourier cosine transform
	SLO-2	Problems in polarcoordinates	Evaluation of surface integrals	Series expansion of x sinx	Problems	Cosine transform of $e^{a\,x}$and evaluating integrals
S-12	SLO-1	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
	SLO-2	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
S-13	SLO-1	Change of order of integration	Green's theorem and its application	Root mean square value of the functions	Application of cosine series expansion	Properties of Fourier sine and cosine transform
	SLO-2	Problems in change of order of integration	Problems on Green's Theorem	RMS values for $f(x)=x^2$in(-1,1)	Cosine seies for $f(x)= x^2$	Properties of Fourier sine and cosine transform
S-14	SLO-1	Problems in change of order	Gauss divergence theorem and its Application	Parseval's indentity	Application of sine series expansion	Related problems
	SLO-2	Problems in change of order	Verification of Gauss Divergence Theorem for Cubes	Deduction of $\Sigma(1/n^{4})$	Sine series for f(x)=x	Cosine transform of $1/(x^2+a^2)$
S-15	SLO-1	Change of variable	Verification of Gauss Divergence Theorem for Cubes	Deduction of $\Sigma(1/n^{4})$ where n is odd	Harmonic Analysis for sine series	Convolution theorem
	SLO-2	Problems in change of variable	Verification of Gauss Divergence Theorem for Cuboid	Related problems	Related Problems	Proof of convolution theorm
S-16	SLO-1	Problems in change of variable	Stoke's theorem	Harmonic Analysis	Harmonic Analysis for sine series	Problems using convolution
	SLO-2	Problems in change of variable	Application	Problems	Related Problems	Self reciprocal under sine transform
S-17	SLO-1	Application of triple integrals	Verification of Stoke's Theorem	Harmonic Analysis	Harmonic Analysis for cosine series	Self reciprocal under cosine transform
	SLO-2	Problems	Verification of Stoke's Theorem	Problems	Related Problems	Evaluation of integrals using identities
S-18	SLO-1	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
	SLO-2	Tutorials	Tutorials	Tutorials	Tutorials	Tutorials
Learning Resources						

Learning Resources	1. P. R. Vittal & V. Mallini. Vector Calculus, Fourier series and Fourier transforms,Margham Publications, 2004. 2. Grewal B.S. Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2012. 3. S. Narayanan and Manickavachagam Pillai, Vector algebra and Analysis, S. Viswanathan Pvt, Ltd., 1995.	4. S.Narayanan and Manickavachagam Pillai, calculus, Volume III,Vija Nicole Imprints Pvt.Ltd, Chennai, 2004. 5. A.R.Vasistha and R.K.Gupta, Integral transforms, Krishna Prakashan media Pvt Ltd., New Delhi, 2011. 6. S.Narayanan, R.Hanumantha and T.K.Manickavachagam Pillai, Ancillary Mathematics, Volume I & II, S.Viswanathan Printers, Chennai, 2007.

Learning Assessment											
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										

Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. K. Ganesan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mr. L. S. Senthilkumar, SRMIST Mrs. G. Krishnaveni, SRMIST

Course Code	UCD20S02L	Course Name	Quantitative Aptitude and Reasoning	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLR-1 :	Demonstrate various principles involved in solving mathematical concepts																		
CLR-2 :	Develop interest and awareness in students regarding profit/ loss, interest calculations and average																		
CLR-3 :	Critically evaluate basic mathematical concepts related to mixtures and alligations, permutation and combination, time and work																		
CLR-4 :	Provide students with skills necessary to generate and interpret data and concepts related to time, speed and distance and blood relation.																		
CLR-5 :	Enable students to understand reasoning skills																		
CLR-6 :	Create awareness in students regarding the various concepts in quantitative aptitude and reasoning skills and also its importance in various competitive exams																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	Understand, analyze and solve questions based on numbers, logarithms.	3	80	70	H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
CLO-2 :	Create, solve, interpret and apply basic mathematical models which are applicable in our day to day life	3	80	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-3 :	Understand the concepts of mixtures and alligations, permutation and combinations, probability, time and work and to approach questions in a simpler and innovative method	3	85	70	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-4 :	Understand the concept in time ,speed and distance	3	85	80	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-5 :	Ability to solve the problems on reasoning	3	85	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-6 :	Able to face different competitive exams	3	80	70	M	H	M	H	-	M	-	H	-	M	-	H	M	-	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	**Classification of numbers**	**Profit and Loss-Introduction**	Mixtures and Alligations-Introduction	Time, Speed and Distance-Problems on Trains	**Direction Sense-Introduction**
	SLO-2	**Test of divisibility**	**Profit and Loss- Basic Problems**	Mixtures and Alligations-Problems	Time, Speed and Distance-Boats & Streams	**Direction Sense-Problems**
S-2	SLO-1	**Unit digit**	Statistics-Introduction	Permutation –Introduction& Basics	**Data Interpretation – Bar chart**	**Number Series**
	SLO-2	**Tailed zeroes**	Statistics-Mean, Median, Mode	Combination-Introduction& Basics	**Data Interpretation – Pie chart**	**Word Series**
S-3	SLO-1	**HCF, LCM**	**Simple Interest-Introduction,Formulas &Problems**	Probability-Introduction &Basics	**Data Interpretation – Table**	**Seating Arrangements - Linear**
	SLO-2	**HCF, LCM - Solving problems**	**Compound Interest-Introduction ,Formulas &Problems**	Probability-Problems	**Data Interpretation – Line graph**	**Seating Arrangements - Circular**
S-4	SLO-1	**Logarithm –Introduction of log rules**	**Word problems on Line equations-Introduction**	Time and work-Introduction	**Data sufficiency-Introduction and Basics**	**Puzzles-Concepts**
	SLO-2	**Logarithm –Applications of log rules**	**Word problems on Line equations- Basic problems**	Time and work-Men and Work	**Data sufficiency-Problems**	**Puzzles-Problems**
S-5	SLO-1	**Percentage -Introduction**	**Averages-Introduction & Basics**	Time and work-Pipes &Cisterns(Introduction)	**Blood relation-Introduction**	**Clocks-Concepts Discussion**
	SLO-2	**Percentage- Basic problems**	**Averages-Tricky Problems**	Time and work-Pipes &Cisterns(Problems)	**Blood relation-Problems**	**Clocks-Problems**
S-6	SLO-1	**Percentage-Increasing & Decreasing functions**	**Ratio and Proportions-Introduction**	Time, Speed and Distance-Introduction	**Coding – Decoding-Introduction**	**Calendars-Introduction of basic concept**
	SLO-2	**Percentage- Miscellaneous problems**	**Ratio and Proportions-Basics & problems**	Time, Speed and Distance-Basic problems	**Coding – Decoding-Different types**	**Calendars-Problems**

Learning Resources	
	1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition
	2. Dr. Agarwal.R.S, Quantitative Aptitude for Competitive Examinations, S. Chand and Company Limited, 2018 Edition
	3. Archana Ram, PlaceMentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018
	4. Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition
	5. Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for competitive examinations, Pearson, 3rd Edition
	6. P A Anand, Quantitative Aptitude for competitive examinations, Wiley publications, e book, 2019

Learning Assessment					
Level	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%) #	CLA-4 (30%) ##
		Practice	Practice	Practice	Practice
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.
CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Dr. P Madhusoodhanan, HoD, CDC, E&T, SRMIST*
		2. Dr. M Snehalatha, Assistant. Professor, CDC, E&T, SRMIST

Course Code	UJK20201L	Course Name	Communication Skills	Course Category	JK	Life Skill Course	L	T	P	C
							0	0	4	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

CLR-1 :	To make the students learn the native speakers' accent.
CLR-2 :	To educate them about word stress of English
CLR-3 :	The enable them to participate in group discussion and debates
CLR-4 :	To improve their participation and participation skills
CLR-5 :	To improve the listening and speaking abilities in English
CLR-6 :	LSRW skills all together is developed in every student

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	Understand the native speakers' exact pronunciation	2	75	60	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-2 :	Master the sound systems of English	2	80	70	H	H	H	-	-	-	-	H	H	H	H	H	-	-	-
CLO-3 :	Have a better Word stress, Rhythm and Intonation	2	70	65	H	H	H	-	H	H	-	-	H	H	H	H	-	-	-
CLO-4 :	Develop Neutral Accent	2	70	70	H	H	H	-	H	-	-	-	-	-	H	H	-	-	-
CLO-5 :	Participate in any conversation with any native speaker	2	80	70	H	H	-	H	-	H	-	H	H	H	H	H	-	-	-
CLO-6 :	Clear any standardized tests conducted to measure the English language ability like IELTS and TOEFL	2	75	70	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to Digital language lab - helps in the listening skills by providing an interactive environment to the students	Learners are enabled to record their speech and listen to it in order to correct their lacuna	Reading software is used to facilitate reading exercises for the students	To enable the students to familiarize with word processor blogging	Students are enabled to learn and pronounce stressed and unstressed words
	SLO- 2	The students will be able to converse fluently	One will know himself where he/ she has gone wrong	Flow in reading will be improved	online publishing. Will be learnt by the students	The practice will lead them to acquire neutral accent and understand foreign accent
S-2	SLO-1	Students are exposed to functional language	Fluency and Pronunciation to be evaluated	The usage of phonetics will be mandated.	Enable the students in learning situational language	Common topics in IELTS speaking test and TOFEL will be provided to assess the students.
	SLO- 2	This exposure will help them pick up fluency	Their standard will measured	reading will be done in the class	Create imaginary situations and students are allowed to engage in conversations	Assessments will be provided for self scrutiny
S-3 – S-4	SLO-1	Lab 1 In the wall of Pink Floyed to be played for the students	Lab 4 Students are given a situation, they need to write a respond for it by writing a letter requesting information or explaining the situation	Lab 7 Introduction to the conversation of a native speaker/ interview of a native speaker	Lab 10 learners are asked to describe some visual information(table/charts/nature) in their own word	Lab 13students will listen to a passage and they need to give a suitable title
	SLO- 2	The students will be able to understand the isolation of a wall. It helps them to enhance their pronunciation	This will lead to understand the English letter conventions	Learners will prove the fluency by listening	They need to have a well organized thought of it using language accurately in a academic style.	Assessment on their language competency and vocabulary
S-5	SLO-1	They get familiarized with pronunciation styles	Learners to record and repeat new wordsagain and again	New words are to be referred in the reading passages and checked with the help of dictionaries	Familiarize the students with e-journals , e-guidance, e-magazines, e-Books, e-Library	Listening topics in the IELTS listening test and TOFEL will be provided
	SLO- 2	American and British styles are differentiated	Untill right prononciation isaquiredis not allowed to go to the Next session	Those new words are to be used in different contexts and sentences	Help students to access them as much as possible	Assessment on their listening capacity is to be provided
S-6	SLO-1	Listening to news bulletins and songswillbeenabled to help them to understand use of vocabulary	Learnerscanspeak English and compare the notes and exchange ideas	Comprehensive skills are enhanced and checked the level	Enable the students to versatile writing	Reading topics in the IELTS reading test and TOFEL will be provided to assess the students.

	SLO- 2	*Will beenabled ti imitae the exact accent and prononciation*	*From the exchangedideascomprehensive questions willbeasked by the otherstudents*	*The levels are informed to the students and Icuna is explained*	Diffrerence in writing and readingisexplained	Assesment on their capacity is explained
S-7 – S-8	**SLO-1**	*Lab 2TedX will be played for the student*	*Lab 5 introduction to semi-formal/ neutral discursive essay will be taught.*	*Lab 8 television news will be broadcasted to them*	*Lab 11learners are given with a set of images where they need to write a story from it*	*Lab 14 students will listen to the great monologues of the time*
	SLO- 2	*It will help them to improve their fluency*	*It will teach them to write coherently and cohesively.*	*It will help them to understand the usage of words and the fluency of speaker*	*It helps them to keen on observation as well as to know their creativity.*	They will learn the importance of pronunciation, stress and pause in a speech
S-9	**SLO-1**	*To enable to listen to authentic sounds of the target language*	*Give different topics to debate to enable them talk fluently*	*The right pronunciation is checked with an access to articles fiction verses and speeches*	*Focus on writing is done*	writing topics in the IELTS writing test and TOFEL will be provided to assess the students.
	SLO- 2	*To enable them imitate the different sounds and accents and make them repeat it*	*To check the pace of their speech*	*Minute details and differences are marked and rectified*	*Conversational skills are enhanced*	Writing skills are assessed and tested
S-10	**SLO-1**	To enable to practice different accents focusing on intonation and voice modulation	*Dialogue delivery be checked by asking them to prepare for their own e- learning materials*	*Read and repeat passages*	Help in professionalwriting	Model IELTS and TOFEL test will be conducted for the students
	SLO- 2	The differences between intonation stress and modulations are explained	*Make the students speak and record*	*Check the ability to repeat the exact pronounciation*	Check and asses theirwritings	Assessment will be provided to the learners
S 11 - S 12	**SLO-1**	*Lab3 After listening to TedX, students need to jot down set of question.*	*Lab 6 learners will be taught to write a review for a film after watching*	*Lab 9 conversation between two people in every day context will be played for the studetns*	*Lab 12 students will listen to the writers note on publishing a novel/ short story*	*Lab 15 they will listen to grammar usage in the form of visual image and song*
	SLO- 2	This will help them to identify the key information in listening text.	*Leaner will need to think for the apt word. Through this language competency will be evaluated*	*It Will help them to understand the target language*	It will helps them to enhance their creativity also the language compétence	They will the foreign language easily and it enhances their competency of it

Learning Resources	***Theory:*** 1. Horizon- English Text Book – Compiled and Edited by the faculty of English Departement, FSH, SRMIST, 2020 2. *English Grammar in Use by Raymond Murphy* 3. *Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007* 4. *R.P. Bhatnagar, English for Competitive Examinations, Trinity Press, 3rd Edition,2016* *5. http://www.aptitudetests.org/verbal-reasoning-test* *6. https://www.assessmentday.co.uk/aptitudetests_verbal.htm*

Learning Assessment

Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**							
		CLA – 1 (20%)		**CLA – 2 (20%)**		**CLA – 3 (30%)**		**CLA – 4 (30%)#**	
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	-	30%	-	30%	-	30%	-	30%
	Understand								
Level 2	Apply	-	30%	-	30%	-	30%	-	30%
	Analyze								
Level 3	Evaluate	-	40%	-	40%	-	40%	-	40%
	Create								
	Total	100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

Course Code	UNS20201L/ UNC20201L UNO20201L/ UYG20201L	Course Name	NSS/NCC/NSO/YOGA	Course Category	EA	Extension Activity	L	T	P	C
							0	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	NSS/NCC/NSO/YOGA		Data Book / Codes/Standards	*Nil*	

Assessment is Fully Internal

Learning Assessment	
Assessment Tools	**Marks**
Continuous Learning Assessment –I (CLA-I)	20 Marks
Continuous Learning Assessment –II (CLA-II)	30 Marks
Continuous Learning Assessment –III (CLA-III)	30 Marks
Continuous Learning Assessment –IV (CLA-IV)	20 Marks
Total Marks	100 Marks

Course Code	UMA20301T	Course Name	PROBABILITY AND STATISTICS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR) :	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1	To understand the concepts of probability and standard distributions.																		
CLR-2	To learnt the concepts of two dimensional random variables.																		
CLR-3	To know how to test the hypothesis.																		
CLR-4	To learnt the concepts of correlation and regression lines.																		
CLR-5	To learnt the different types of analysis of variance.																		
CLR-6	To understand the evaluation of quality control chart.																		
Course Learning Outcomes (CLO) :	At the end of this course, learners will be able to:																		
CLO-1	Get exposed to the random variable and distributions.	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2	Have sound Knowledge in mappings of transformation.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3	Grasp several facts on testing of hypothesis.	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4	Be familiar with Pearson correlation, regression and properties.	3	85	80	H	H		M	-	-	-	-	M	-	-	H	-	-	-
CLO-5	To learnt the different types of Analysis of variance.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6	To know the fundamental concepts in statistical quality control.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Introduction to Probability Concepts and Axioms	Introduction to two dimensional random	Introduction to testing of hypothesis	Introduction to correlation coefficient	Introduction to statistical quality control
	SLO-2	Conditional probability and Multiplication theorem	Two dimensional random variables	Sampling distribution, null and alternative hypothesis	Applications of correlation coefficient	Control chart and types
S-2	SLO-1	Discrete Random Variable	Applications of Two dimensional discrete	One tailed and two tailed test	Karl Pearson's correlation coefficient	Control charts for variable
	SLO-2	Probability mass function, Cumulative distribution	Problems in Two dimensional discrete	Level of significance and critical region	Problems in Karl Pearson's correlation	Applications for control charts for variable
S-3	SLO-1	Continuous Random Variable	Joint probability mass function	Introduction to Large sample test	Problems based on correlation coefficient	Control charts for mean and range
	SLO-2	Probability density function, Cumulative	Cumulative distribution function	Large sample – single proportion	Problems based on correlation coefficient	Applications of control charts for mean and
S-4	SLO-1	Expectation and Variance	Marginal probability distribution	Large sample – difference proportion	Spearman's Rank Correlation coefficient	Problems based on control charts for $\bar{X}$ and R.
	SLO-2	Problems based on Expectation and Variance	Problems in Marginal probability distribution	Problems in Large sample – difference proportion	Problems in Spearman's Rank Correlation	Problems based on control charts for $\bar{X}$ and R.
S-5	SLO-1	Moment Generating Function	Applications of Two dimensional continuous	Large sample – single mean	Repeated Rank Correlation coefficient	Problems based on control charts for $\bar{X}$ and R.
	SLO-2	Problems on Moment Generating Function	Problems in Two dimensional continuous	Problems in Large sample – single mean	Problems based on Repeated Rank	Problems based on control charts for $\bar{X}$ and R.
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Introduction to Binomial distribution	Joint probability density function	Large sample – difference mean	Introduction to Regression	Control charts for mean and standard deviation
	SLO-2	MGF, mean and variance of Binomial distribution	Cumulative distribution function	Problems in Large sample – difference mean	Properties of Regression coefficient	Applications of control charts for mean and
S-8	SLO-1	Applications of Binomial distribution	Marginal probability density function	Introduction to Small samples	Problems based on regression lines	Problems based on control charts for $\bar{X}$ and S
	SLO-2	Problems in Binomial distribution	Problems based on Marginal probability	Small samples – 't' test - single mean	Problems based on regression lines	Problems based on control charts for $\bar{X}$ and S
S-9	SLO-1	Introduction to Poisson distribution	Conditional probability distribution	Small samples – 't' test – difference mean	Introduction to design of experiments	Problems based on control charts for $\bar{X}$ and S

	SLO-2	MGF, mean, variance of Poisson distribution	Conditional probability distribution	Problems based on 't' test - difference mean	Principles of design of experiments	Problems based on control charts for $\bar{X}$ and S
S-10	SLO-1	Applications of Poisson distribution	Independent random variables	Applications of paired 't' test	Analysis of Variance	Control charts for attributes
	SLO-2	Problems in Poisson distribution	Applications on Independent random	Problems of paired 't' test	Application of Analysis of Variance (ANOVA)	Applications for control charts for attributes
S-11	SLO-1	Introduction to Geometric distribution	Expectation and variance for two dimensional	Standard deviation	Analysis of Variance – One way classification	Control charts for number of defective
	SLO-2	MGF, mean, variance and Memory less Property	Problems based on Expectation and variance	Difference between standard deviation	Applications of Analysis of Variance – One way classification	Applications of control charts for number of defective
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Applications of Geometric distribution	Covariance and correlation	Introduction to small sample ' F' - test	Problems in ANOVA - one way classification	Problems based on control charts for number
	SLO-2	Problems in Geometric distribution	Problems based on Covariance and	Applications and properties	Problems in ANOVA - one way classification	Problems based on control charts for number
S-14	SLO-1	Introduction to Exponential distribution	Transformation of random variables.	Problems based on small sample 'F' - test	Problems based on Analysis of Variance - one	Control charts for fraction defective
	SLO-2	MGF, mean, variance and Memoryless Property	Applications of transformation of random	Problems in 'F' - test	Problems based on Analysis of Variance - one	Applications of control charts for fraction
S-15	SLO-1	Applications of Exponential distribution	Problems in transformation of random	Introduction to Chi square test	Analysis of Variance – Two way classification	Problems in p - chart
	SLO-2	Problems in Exponential distribution	Problems in transformation of random	Applications and properties	Applications of Analysis of Variance – Two way	Problems in p - chart
S-16	SLO-1	Introduction to Normal distribution	Central limit theorem (theorem without proof)	Chi square test - Goodness of fit	Problems in ANOVA - Two way classification	Control charts for number of defects per unit
	SLO-2	Normal distribution with Properties	Applications of Central limit theorem	Problems in Chi square test - Goodness of fit	Problems in ANOVA - Two way classification	Applications of control charts for number of
S-17	SLO-1	Applications of Normal distribution	Problems based on Central limit theorem	Chi square test - independence of attributes	Problems based on Analysis of Variance - Two	Problems in C - chart
	SLO-2	Problems in Normal distribution	Problems based on Central limit theorem	Problems in Chi square test - independence of	Problems based on Analysis of Variance - Two	Problems in C - chart
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. T. Veerarajan, Probability, Statistics and Random process, Tata Major Core Graw Hill, 1st reprint, 2004. 2. S. C. Gupta & V. K. Kapoor, Fundamentals of Mathematical Statistics, 11th edition, Sultan chand & sons, reprint, 2007. 3. S. P. Gupta, Statistical Methods, sultan chand publication, 35th edition, New Delhi, 2007.	4. R. A. Johnson, Miller and Freund's, Probability and Statistics for Engineer's, 6th edition, Pearson Education, Delhi, 2006. 5. P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2013.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	30%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-
Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, bvrk@iitk.ac.in	Dr. P. Godhandaraman, SRMIST Dr. V. Suvitha, SRMIST

Course Code	UMA20D01T	Course Name	Number Theory	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Introduce divisibility conditions in detail and the prime numbers	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Employ congruences and Euler's function																		
CLR-3 :	Introduce the concept of quadratic residues arithmetic functions																		
CLR-4 :	Introduce the arithmetic functions																		
CLR-5 :	Understand the role of sum of squares																		
CLR-6 :	Address the concept of Fermat's last theorem																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Gain an insight on elementary number theory concepts	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Be familiar with prime numbers and congruence	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understanding Euler function and applications	2	75	60	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Analyse thoroughly the arithmetic functions	2	70	70	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Classify the role of sum of two squares and four squares	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Gain an insight of Fermat's last theorem	2	75	65	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction- Divisors	Basic properties of congruences	Quadratic residues	Introduction of Riemann function	Sum of squares
	SLO-2	Properties: (i) If a|b and b|c then a|c,	Modular arithmetic	Group of quadratic residues	Riemann zeta function	Sum of two squares
S-2	SLO-1	(ii) if a|b and c|d then ac|bd,	The arithmetic Zp	Legendre symbol	Convergence	Pigeonhole principle
	SLO-2	(iii)if m≠0, then a|b if and only if ma|mb,	Carmichael numbers	Properties of Legendre symbol	Application to prime numbers	Thue's lemma
S-3	SLO-1	(iv)if d|and a≠0 then |d|≤|a|	Carl friedrich gauss	Evaluation of (-1/p) and (2/p)	Functional equation of Riemann function	Fermat theorem
	SLO-2	Bizout's identity	Polynomial congruences modulo p	Gauss' lemma	Random integers	The Gaussian integers
S-4	SLO-1	Least common multiples	Lagrange's theorem	Quadratic reciprocity	Evaluating ζ(2)	Sum of three square
	SLO-2	Linear equation	Linear congruences	Euler's criterion	Evaluating ζ(2k)	Euler theorem
S-5	SLO-1	Diophantine equation	Chinese remainder theorem	Quadratic congruence	Dirichlet series	Lagrange theorem
	SLO-2	Prime numbers	Application of Chinese remainder theorem	Quadratic residue with prime power moduli	Euler products	Sums of four square
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Prime power factorisations	Simultaneous linear congruence	Quadratic residue with arbitrary moduli	Complex variables	Digression on quaternions
	SLO-2	Distribution of primes	Simultaneous non-linear congruence	Arithmetic of function	Hurwitz zeta function	Minkowski's theorem
S-8	SLO-1	Pierre de Fermat	Binary representations of integers	Definition of examples	Integral representation for the Hurwitz zeta function	Fermat's last theorem

	SLO-2	Fermat's little theorem	Decimal representations of integers	Multiplicative functions	A contour integral representation for the Hurwitz zeta function	Pythagoras's theorem
S-9	SLO-1	pseudoprimes	Residue classes	|Qn| is multiplicative function	The analytic continuation of the Hurwitz zeta function	Pythagorean triples
	SLO-2	Wilson's theorem	Complete residue systems	Divisor function are multiplicative	Hurwitz formula	The classification of Pythagorean triples
S-10	SLO-1	Fermat-kraitchik factorization method	Reduced residue systems	Perfect numbers	Approximation of ζ(s,a) by finite sums	Isosceles triangles
	SLO-2	Euler's phi-function	Euler-fermat theorem	Example of Perfect numbers	Bernoulli numbers	irrationality
S-11	SLO-1	Euler's theorem	Solving congruence mod (p^e)	The Mobius inversion formula	Properties of Bernoulli numbers	Fermat
	SLO-2	Some properties of the phi-function	The principal of cross-classification	Application of Mobius inversion formula	Bernoulli polynomials	The case n=4
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Goldbach conjecture	Groups and subgroups	Mobius function	Inequalities for | ζ(s,a)|	Odd prime exponents
	SLO-2	Mersenne primes	Elementary properties of groups	Properties of Mobius function	Inequalities for | L(s,χ)|	Lame
S-14	SLO-1	Primality testing	The group Un	The Dirichlet characters	Inequalities for | 1/ζ(s)|	kummer
	SLO-2	factorisations	Primitive roots	Real value Dirichlet characters	Inequalities for | ζ'(s)/ ζ(s)|	Introduction of partitions
S-15	SLO-1	Division algorithm	The Group $U_{pe,}$ p is an odd prime	Primitive Dirichlet characters	Zero's free regions for ζ(s)	Goldbach conjecture
	SLO-2	Special divisibility test	The group U_{2^e}	Dirichlet product	Upper bound for |ζ(s)|	Representation by squares
S-16	SLO-1	Euclidean algorithm	The existence of primitive roots	Properties of Dirichlet products	Upper bound for |ζ'(s)|	Warming's problem
	SLO-2	Greatest common divisor	Applications of primitive roots	Dirichlet inverse function	Non-vanishing of ζ(s) on the line σ=1	Geometric representation of partitions
S-17	SLO-1	Sieve of eratesthenes	The algebraic structure of U_n	The partial sums of Dirichlet product	Prime number theorem	Generating functions for partitions
	SLO-2	Application to the divisor function	The universal exponent	Identity function for the partial sum of Dirichlet product	Proof of prime number theorem	Euler's pentagonal-number theorem
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. David M. Burton (2007). Elementary Number Theory (7th edition). McGraw-Hill. 2. Gareth A. Jones & J. Mary Jones (2005). Elementary Number Theory. Springer.	3. T.M. Apostol, Introduction to Analytic Number theory, Springer Valley, 1976. 4. Neville Robbins (2007). Beginning Number Theory (2nd edition). Narosa.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. Bapuji Pullepu, SRMIST Mr. U. Rengarasu, SRMIST

Course Code	UMA20D02T	Course Name	OPERATIONS RESEARCH	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To understand the concepts of linear programming problem	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To learn the concepts of transportation and assignment problem																		
CLR-3 :	To understand the concepts of queuing theory																		
CLR-4 :	To learn the basic concepts of game theory																		
CLR-5 :	To understand the scheduling problems																		
CLR-6 :	To provide the knowledge of optimization techniques and approaches.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Explain the linear programming problem and its properties	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Explain the concepts of transportation and Assignment problem	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Describe several facts on queuing theory	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Relate the different types of game theory	3	85	80	H	H		M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Describe the different types of scheduling problems	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Explain the fundamental concepts in linear programming problem and its applications.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Linear programming problem –Definition.	Transportation model-Introduction	Introduction to queuing models	Game theory- Introduction	Introduction -Network scheduling
	SLO-2	linear programming problem-assumptions	Mathematical formulation	Queuing theory	Two person zero sum games	Network models
S-2	SLO-1	Formulation of linear programming problem	North west corner rule	Queuing system	Main characteristics	Construction of Networks
	SLO-2	Mathematical formulation	problems	Characteristics of Queuing system	Saddle point	Network and basic components
S-3	SLO-1	Mathematical formulation –Examples	Practice Problems	Classifications of queues	**Maximin-Minimax Principle**	Rules of Network construction
	SLO-2	Mathematical formulation Examples	Vogels approximation method	Poisson arrivals and exponential service times	Saddle point and value of the game	Time calculation in Networks
S-4	SLO-1	Graphical Method Introduction	problems	single server model	The Maxmini Principle–problems	Shortest route problem
	SLO-2	Graphical Method problems	More problems	(M/M/1): (∞/FIFO)-Introduction	The Maxmini Principle–problems.	Problems based on Shortest route
S-5	SLO-1	Graphical Method problems	MODI method-Algorithm	Problems in (M/M/1): (∞/FIFO)	The Maxmini Principle–problems	Maximum flow model
	SLO-2	Graphical Method problems	Stepping stone method	Problems in (M/M/1): (∞/FIFO)	Minimax principle	Network scheduling by CPM
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Types of solution	Unbalanced transportation problem.	Practice Problems	Minimax principle – problems	CPM Procedure
	SLO-2	Basic and non basic variables	Problems	Problems in (M/M/1): (∞/FIFO)	Minimax principle – problems	Network scheduling by PERT

S-8	SLO-1	Slack variables	Maximization case in Transportation problem	(M/M/1): (N/FIFO)--Introduction	Mixed Strategies, without saddle point	PERT procedure
	SLO-2	Procedure of simplex method	Problems	Problems in (M/M/1): (N/FIFO)	Problems based on Mixed Strategies	Assumptions in PERT
S-9	SLO-1	simplex method Problems	Practice Problems	Practice Problems	Problems based on Mixed Strategies	Practice Problems
	SLO-2	simplex method Problems	Assignment problem—mathematical formulation	Problems in (M/M/1): (N/FIFO)	2 x 2 rectangular Games--introduction	Difference between CPM and PERT
S-10	SLO-1	simplex method Problems	Assignment algorithm	Problems in (M/M/1): (N/FIFO)	Solution of 2 x 2 rectangular Games	CPM-PERT calculations
	SLO-2	Artificial variable techniques	problems	Multiple server model	Solution of 2 x 2 rectangular Games	CPM-PERT calculations
S-11	SLO-1	Big M method - Introduction	problems	(M/M/C): (∞/FIFO)--Introduction	Domination Property	CPM-PERT calculations
	SLO-2	Big M method problems	Unbalanced Assignment Models	Characteristics of (M/M/C): (∞/FIFO)	Domination Property—General Rule	CPM-PERT calculations
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Big M method problems	problems	Problems in . (M/M/C): (∞/FIFO)	solving game problem using dominance property	CPM-PERT calculations
	SLO-2	Duality in LPP	Practice Problems	Problems in . (M/M/C): (∞/FIFO)	solving game problem using dominance property	Cost Analysis
S-14	SLO-1	Formulation of dual problems	Hungarian method	Problems in . (M/M/C): (∞/FIFO)	solving game problem using dominance property	Crashing
	SLO-2	Primal-dual relationships	Algorithm	(M/M/C): (N/FIFO)--Introduction	(2 x n) and (m x 2) - graphical method	Procedure for least cost schedule
S-15	SLO-1	Problem solving using duality	Problems based on Hungarian method	Characteristics of (M/M/C): (N/FIFO)	Solving problem graphically	Examples
	SLO-2	More problems	Practice Problems	Problems in (M/M/C): (N/FIFO)	More problems	More problems
S-16	SLO-1	Dual Simplex method	Travelling salesman problem	Problems in (M/M/C): (N/FIFO)	Solving problem graphically	Scheduling and crashing of network
	SLO-2	Dual Simplex method--Algorithm	Algorithm	Problems in (M/M/C): (N/FIFO)	Replacement Problems.	Practice problems
S-17	SLO-1	Solve LPP using dual simplex method	Problem in travelling salesman	Problems in (M/M/C): (N/FIFO)	problems	project scheduling with limited sources
	SLO-2	More problems	More problems	Applications	Practice problems	Practice problems
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Kandiswarup, P. K. Gupta, Man Mohan, Operations Research, S. Chand & Sons Education Publications, New Delhi, 12th Revised edition,2004. 2. Prof.V.Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan, Resource Management Techniques, A.R.Publications, 2012. 3. Prem Kumar Gupta D. S. Hira, Operations Research, 5th Edition, S. Chand & Company Ltd., Ram Nagar, New Delhi, 1998. 4. S.Dharani Venkata Krishnan, Operations Research Principles and Problems, Keert Publishing House PVT Ltd, 2005.	5. H.A. Taha, Operations Research, An Introduction, PHI, 2008. 6. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982. 7. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008. 8. Hitler Libermann Operations Research: McGraw Hill Pub. 2009.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. K. Ganesan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs. V. Vidya, SRMIST

Course Code	UMA20D03T	Course Name	COMBINATORICS	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn about recurrence relation	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To know about permutation																		
CLR-3 :	To understand Assignment problems																		
CLR-4 :	To improve the knowledge in Fibonacci relation																		
CLR-5 :	To understand about inclusion and exclusion principle																		
CLR-6 :	To relate the concepts of relations																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	To know about recurrence relation	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	To apply the concepts of permutation	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	To familiar with Assignment problems	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	To understand Fibonacci relation	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To improve the knowledge in inclusion and exclusion principle	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	To apply the fundamental concepts of combinatorics	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	The Rule of Sum	Generalized Permutations	Generating Functions-An introduction	Recurrence relation-An introduction	An Introduction of group theory in Combinatorics
	SLO-2	Problems by using the rule of sum	Problems in Generalized Permutation	Ordinary Generating Functions	Recurrence relation definition and examples	An Introduction of group theory in Combinatorics
S-2	SLO-1	Extension of Sum rule	Generalized Combination	Problems in Ordinary Generating Functions	The first order recurrence relation-An introduction	The Burnside-Frobenius Theorem
	SLO-2	Problems by using the extension of sum rule	Problems in Generalized Combination	The reciprocal of the Generating Functions	Problems in recurrence relation	Problems using the Burnside-Frobenius Theorem
S-3	SLO-1	The Rule of Product	Sequences and selections	Problems in reciprocal of the Generating Functions	Problems in recurrence relation	The Burnside-Frobenius Theorem with weights
	SLO-2	Problems using the Rule of Product	Duality Principle of Distribution	Uniqueness of Base-b representation in Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-An introduction	Permutation groups
S-4	SLO-1	Extension of Product rule	Problems in Sequences and selections	Partition of Integers	The second order linear homogenous recurrence relation with constant coefficients-Problems with distinct real roots	Permutation groups and their cycle indices
	SLO-2	Problems by using the extension of Product rule	The Inclusion-Exclusion Principle	Partition of Integers in Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-Problems with distinct real roots	Isomorphic- problems
S-5	SLO-1	The rule of sum and product	Derangements and Other Constrained Arrangements	Problems in Partition of Integers	The second order linear homogenous recurrence relation with constant coefficients-Problems with distinct real roots	Cyclic and abelian problems

	SLO-2	More problems	Combinatorial Number Theory	Problems in Partition of Integers in Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-Problems with complex roots	Characterization theorem for cyclic group-problems
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Permutations	Mobius function	Self-conjugate - definition	The second order linear homogenous recurrence relation with constant coefficients-Problems with complex roots	Permutation groups and their cycle indices
	SLO-2	Problems by using Permutations	Generalized Inclusion-Exclusion Principle	Problems in Self-conjugate	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Cauchy's formula-problems
S-8	SLO-1	Permutations with repetition	Problems in Generalized Inclusion-Exclusion Principle	Euler's Theorem	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Geometric duals-cube regular octahedron and regular tetrahedron
	SLO-2	Circular Permutation	The Permanent of a Matrix	Problems using Euler's Theorem	The non-homogenous recurrence relation-An introduction	Cayley's theorem
S-9	SLO-1	Combinations	Problems in Permanent of a Matrix	Euler's first identity	The non-homogenous recurrence relation–problems	Regular icosahedrons
	SLO-2	Problems by using Combinations	Rook Polynomials	Problems using Euler's first identity	Towers of Hanoi –An introduction	Definition of type and weight
S-10	SLO-1	Combinations: The Binomial Theorem	Expansion formula for Rook Polynomials	Euler's second identity	Towers of Hanoi related with recurrence relation-problem	Problems to find type and weight
	SLO-2	Problems by using Binomial Theorem	Problems by using Rook Polynomials	Problems using Euler's second identity	Recurrence relation related with mathematics of finance	Cycle index
S-11	SLO-1	Combination with repetition	Hit Polynomials	Exponential Generating Functions	More problems in the non-homogenous recurrence relation	Circular or cyclic symmetries
	SLO-2	Combination with repetition	Problems by using Hit Polynomials	Problems in Exponential Generating Functions	The method of generating functions-An introduction	Dihedral symmetries
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	The method of generating functions-Problems	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	The method of generating functions-Problems	Tutorial Session
S-13	SLO-1	Pascal's Identity	Systems of Distinct Representatives (SDR) and Coverings in graphs	Maclaurin series expansions of exponential function	More problems in the method of generating functions	Poliya's enumeration theorems-An introduction
	SLO-2	Problems by using Pascal's Identity	Rado's Theorem	Dobinski's Equality	Tutorial Session	Poliya's first enumeration theorems
S-14	SLO-1	Convolution rule or Vandermonde identity	Konig-Egervary Theorem	Problems using Dobinski's Equality	Tutorial Session	Problems using Poliya's first enumeration
	SLO-2	Problems by using Convolution rule or Vandermonde identity	Konig's Theorem	Bernoulli numbers- An introduction	The special kind of non linear recurrence relations-An introduction	Poliya's second enumeration theorems
S-15	SLO-1	Newton's identity	Sperner's Theorem	Bernoulli numbers-Problems	Problems in the special kind of non linear recurrence relations	Problems using Poliya's second enumeration
	SLO-2	Problems by using Newton's identity	Types in Sperner's Theorem	Bernoulli polynomial	Problems in the special kind of non linear recurrence relations	More Problems
S-16	SLO-1	Pigeonhole Principle	Symmetric Chain Decomposition	Problems in Bernoulli polynomial	More problems in the special kind of non linear recurrence relations	Fermat's little theorem
	SLO-2	Problems based on Pigeonhole Principle	Partially Ordered sets	The summation operator	Historical review of the recurrence relation	Problems using Fermat's little theorem
S-17	SLO-1	Generalisation of the Pigeonhole Principle	Dilworth's Theorem	The summation operator-Problems	Summary and Historical review of the recurrence relation	Benzene ring
	SLO-2	More Problems	Problems in Dilworth's Theorem	More problems	More summary in the review of the recurrence relation	Problems in Benzene ring
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Jan Anderson, A First Course in Combinatorial Mathematics, Oxford Applied Mathematics and Computing Science Series, UK, 2013. 2. R.P.Grimaldi, B.V.Ramana, Discrete and Combinatorial Mathematics-An Applied Introduction, 5th Edition, Pearson Education, 2010	3. V.K.Balakrishnan, Combinatorics, Schuam Series, 1996. 4. Russell Merris, Combinatorics, John Wiley & Sons, 2003.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	30%	-	30%	-	30%	-	30%	-

Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. R. Senthamarai, SRMIST

Course Code	UPY20A01J	Course Name	Allied Physics	Course Category	G	Generic Elective Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	Understand the fundamentals of physics	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO - 1	PSO - 2	PSO - 3
CLR-2:	Evaluate and learn the structural, optical, nuclear and electronic properties of solids																		
CLR-3:	Emphasize the significance of green technology and its applications																		
CLR-4:	Gain comprehensive knowledge and sound understanding of fundamentals of light and material properties																		
CLR-5:	Recognize how and when physics methods and principles can help address problems in their major																		
CLR-6:	Develop skills on practical, analytical problem solving in physics																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Understand and solve problems on fundamentals of physics	2	80	75	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-2 :	Acquire knowledge on materials properties	2	80	70	H	M	M	H	M	H	H	H	M	H	M	H	M	M	M
CLO-3 :	Correlate the acquired knowledge and use it for various applications	2	75	70	H	M	H	H	H	H	H	M	H	H	H	H	H	H	H
CLO-4 :	Familiarize themselves with interaction of light and matter	2	80	75	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H
CLO-6 :	Apply physics methods and principles to solve problems in the majors.	2	80	75	H	H	H	H	H	M	H	H	M	H	M	H	H	H	H
CLO-5 :	Learn magnetic, electrical and optical properties of materials	2	80	70	H	H	H	H	H	M	H	H	M	H	M	H	H	H	H

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Sources of conventional energy	Space lattice basis	Kinetic theory of gases	Electric charge - conservation of charge	Time period - amplitude - phase
	SLO-2	Need for non - conventional energy resources	Unit Cell, lattice parameters	Basic postulates	Permittivity	Wave nature of light
S-2	SLO-1	Solar energy and solar cells and its applications	Two dimensional and three dimensional Bravais lattices	Ideal gas laws	Coulomb's law	Huygens's principle
	SLO-2	calculating energy generation by a solar cell	The seven crystal systems	Numerical problem solving on Ideal gas laws	Numerical problem solving on Coulomb's law	Numerical problem solving on amplitude, phase
S-3	SLO-1	Bio mass energy	Cubic crystal system	Van Der Waal's equation of states	Electric field	Interference
	SLO-2	Generation and applications of bio mass energy	Crystal symmetry	Derivation of Van Der Waal's equation of states	Electric potential	Young's double slit experiment
S-4	SLO-1	Wind energy generation and applications	Reciprocal lattice and its importance	Pressure of an ideal gas	Gauss's law	Coherence
	SLO-2	Numerical evaluation of wind energy generation	Density and atomic packing fraction	Derivation of Pressure of an ideal gas	Applications of Gauss's law	Interference from thin films
S-5 to S-8	SLO-1	Introduction to the Lab experimentation	Calculation of lattice cell parameters by X-ray diffraction	Determination of specific heat capacity of the liquid by Newtons's law of cooling	Calibration of Voltmeter using potentiometer	Determination of dispersive power of a prism using spectrometer
	SLO-2					
S-9	SLO-1	Nuclear energy - Atomic structure	Numerical on Density and atomic packing fraction	Laws of thermodynamics	Numerical problem solving on Gauss's law	Michelson's interferometer
	SLO-2	Alpha, beta and gamma radiation	Crystal directions and planes	Problem solving on laws of Thermodynamics	Conductors and dielectrics	Diffraction - Wave theory of light
S-10	SLO-1	Law of radioactive decay	Introduction to Miller indices	Entropy	Electric Current	Numerical problem on interference
	SLO-2	Example problems in radioactivity	Numerical on Miller indices	Calculating numerical on entropy change	Problem on dielectrics and conductors	Light and Optics

S-11	SLO-1	Decay constant	Interplanar distance	Change of entropy in reversible and irreversible processes	Ohm's law	Fermat's principle
	SLO-2	Half-life and mean life	Numerical on interplanar distance	Change of entropy in irreversible processes	Magnetic induction	Laws of reflection and refraction
S-12	SLO-1	Nuclear energy	Hexagonal closely packed (HCP) structure	Low temperature	Permeability and susceptibility	Total internal reflection
	SLO-2	Applications of nuclear energy	Derivation of HCP atomic packing fraction	Joule - Kelvin effect-introduction	Numerical problem solving on Permeability and susceptibility	Illustrations of total internal reflection
S-13-S16	SLO-1	Study of the I-V Characteristic of a Solar Cell	Dielectric constant Measurement	Determination of thermal conductivity of a bad conductor using Lee's disc method	Calibration of Ammeter using potentiometer	Study of attenuation and propagation characteristics of optical fiber cable
	SLO-2					
S-17	SLO-1	Mass defect and binding energy	Numerical problem solving on HCP structure	J-K effect- theory	Magnetic field due to a current carrying conductor-Biot-Savart's law	Problem solving on total internal reflection
	SLO-2	Solving numerical based on binding energy and mass defect.	Diamond crystal structure	Applications of J-K effect	Numerical problem solving on Biot-Savart's law	Mirrors and lenses
S-18	SLO-1	Fission reaction	Derivation of APF for diamond structure	Liquefaction of gases	Ampere's circuital law	Lens makers formula
	SLO-2	Evaluating nuclear energy generation by fission reaction	Numerical problem solving on diamond structure	Linde's process	Faraday's law	Problem solving on Lens makers formula
S-19	SLO-1	Fusion reaction	X-ray diffraction	Nitrogen gas liquefaction	Basic Electronics	Defects of images
	SLO-2	Fusion energy cycles	Problem solving on X-ray diffraction	H, He gas liquefaction	P and N type semiconductors	Coma distortion
S-20	SLO-1	Biological effects of radiation	Single crystal diffraction	Adiabatic demagnetization-introduction	Junction Diode	Spherical aberration in lenses
	SLO-2	Numerical problems involving Nuclear energy	powder diffraction	Working principle of adiabatic demagnetization-	Characteristics of Junction Diode	Chromatic aberration in lenses
S-21 - 24	SLO-1	Hall effect- Hall coefficient determination	Revision class for experiments	Determination of specific heat capacity of the liquid by Joule's calorimeter method	Band gap determination using Post Office Box – Specific resistance	Revision class for experiments
	SLO-2					

Learning Resources	1. Modern Physics, Murugeshan and K. Sivaprasath, (S. Chand publications, revised edition, 2015). 2. Fundamentals of Physics, Resnick R. and Halliday D., (Wiley Publication, 8th Edition, 2011)	3. Heat and Thermodynamics, Zemansky M. W. and Ditlman R.H., (Tata McGraw Hill, 2011) 4. Allied Physics I, Sundaravelusamy A., (Priya Publications, 2009)

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
	Understand										
Level 2	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
	Analyze										
Level 3	Evaluate	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Dr. N Vijayan, NPL, nvijayan @nplindia.org	Prof. S Balakumar, University of Madras, balakumar@unom.ac.in	Dr. Gunasekran, SRMIST

Course Code	UMA20S01L	Course Name	C Programming	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand the basics of C language	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To relate the concepts of operators																		
CLR-3:	To understand concepts of array																		
CLR-4:	To learn the concepts of arguments																		
CLR-5:	To learn the concepts of create file																		
CLR-6:	To relate the concepts of pointers																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Identify situations where computational methods and computers would be useful	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2:	Given a computational problem, identify and abstract the programming task involved.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Approach the programming tasks using techniques learned and write pseudo-code.	2	70	65	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Choose the right data representation formats based on the requirements of the problem	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Write the program on a computer, edit, compile, debug, correct, recompile and run it.	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module- III (12)	Module- IV (12)	Module- V (12)
S-1 to S-4	SLO-1	Fundamentals of C programming	Conditional Control statement	Program for one dimensional array.	Program for arguments with return value.	Program to create file
	SLO-2	Fundamentals of C Programming	Conditional Control statement	Program for one dimensional array.	Program for arguments with return value.	Program to create file
S-5 to S-8	SLO-1	Basic Exercises in C	Unconditional Control statement	Program for two dimensional array.	Program for no arguments with return value.	Program for Structure
	SLO-2	Basic Exercises in C	Unconditional Control statement	Program for two dimensional array.	Program for no arguments with return value.	Program for Structure
S-9 to S-12	SLO-1	Operators	Loop constructs	Program for multi-dimensional array.	Program for no arguments with return value.	Pointer
	SLO-2	Operators	Loop constructs	Program for multi-dimensional array.	Program for no arguments with return value.	Pointer

Learning Resources	
1. E. Balagurusamy, Programming in ANSI C, 6e, Mc Graw-Hill Pvt Ltd, New Delhi.	4. Al Kelley, Ira Pohl, A Book on C, Addison Wesley Longman, Inc.
2. Brian W. Kernighan, Dennis M. Ritchie, C Programming Language, Second Edition, Prentice-Hall Publication-2012	5. Gary J. Bronson, ANSI C Programming, Cengage Learning India Private Ltd, New Delhi.
3. Byron Gotteried, Programming with C, Third edition, Tata Mc Graw-Hill Pvt Ltd.	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%

	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Prof. K. S. Ganapathy Subramanian, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. M. Suresh, SRMIST

Course Code	UMA20S02L	Course Name	Java Programming	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To understand the basics of Java language																		
CLR-2 :	To relate the concepts of operators																		
CLR-3 :	To understand concepts of statements																		
CLR-4 :	To learn the concepts of array																		
CLR-5 :	To relate the concepts of inheritance																		
CLR-6 :	To understand concepts of class and object																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Identify situations where computational methods and computers would be useful	2	75	60	H	-	H	-	H	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Given a computational problem, identify and abstract the programming task involved.	2	80	70	M	H	-	-		-	-	-	-	-	-	-	-	-	-
CLO-3 :	Approach the programming tasks using techniques learned and write pseudo-code.	2	70	65	H	H	-	H	H	H	-	-	-	-	-	-	-	-	-
CLO-4 :	Choose the right data representation formats based on the requirements of the problem	2	70	70	H	-	H	-	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand	2	80	70	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Write the program on a computer, edit, compile, debug, correct, recompile and run it.	2	75	70	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module- III (12)	Module- IV (12)	Module- V (12)
S-1 to S-4	SLO-1	Fundamentals of OOPS	Constant, variable and data types	Decision making and branching	string	Using a package
	SLO-2	Fundamentals of OOPS	Constant, variable and data types	Decision making and branching	string	Using a package
S-5 to S-8	SLO-1	Basic Exercises in Java	Operators and Expression	Class objects and methods	vector	Hiding class
	SLO-2	Basic Exercises in Java	Operators and Expression	Class objects and methods	vector	Hiding class
S-9 to S-12	SLO-1	Overview of Java Programming	Decision making and looping	Arrays	Multiple inheritance	Draw line, rectangle, arcs, ellipse, polygons, Bar chart.
	SLO-2	Overview of Java Programming	Decision making and looping	Arrays	Multiple inheritance	Draw line, rectangle, arcs, ellipse, polygons, Bar chart.

Learning Resources	
1. Java How to Progam, Paul Deitel, Harvey Deitel, 8e, PHI Learning Pvt, New Delhi-01.	4. Beginning Java SE6 Game Programming, Jonanthan s, Harbour, 3e, Printed by Course Technology, USA.
2. Core Java, Cay S. Horstmann, Gary Cornell, Vol-1, Sun Microsystems Press, Peason Education Asia.	5. Programming with Java, E. Balagurusamy, 4e, Mc Graw-Hill Pvt Ltd, New Delhi.
3. Design Patterns in Java, Steven John Metsker, William C. Wake, 7e, Published by Dorling Kindersley.	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%

	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
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Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. M. Suresh, SRMIST

Course Code	UMA20S03L	Course Name	Scientific Documentation and Statistical Tools	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	Understanding the latex program, construct apply them for the report writing.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO – 1	PSO - 2	PSO – 3
CLR-2:	Apply the specific packages in the latex program to create a document with mathematical symbols																		
CLR-3:	Applying the bibliography concepts to create a bib file, journal paper, beamer presentation																		
CLR-4:	Understanding the GNU plotting concepts and construct a graph																		
CLR-5:	Apply the PSPP concepts to construct the statistical report																		
CLR-6:	Create insights to the concepts and prepare a dissertation.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Apply the concept of Latex, to create a typesetting program for report writing.	2	80	95	M	-	H		H	-	-	-	-	H	-	H	-	-	H
CLO-2:	Apply the concept of Latex, to create a program for a document with mathematical symbols	2	80	80	H	-	H	H	H	-	-	-	-	H	-	H	-	-	H
CLO-3:	Apply the concept of Latex, to create a typesetting for a project report, article and beamer presentation	2	80	80	H	H	H	H	H	-	-	-	H	H	-	H	H	-	-
CLO-4:	Apply the concept of GNU Plot, to plot a graph for the mathematical functions	2	80	80	H	H	H	H	H	-	-	-	-	H	-	H	-	-	H
CLO-5:	Apply Hypothesis testing, Descriptive statistics to analyze and prepare a report for the given data.	2	80	80	H	H	H	H	H	-	-	-	H	H	-	H	-	-	H
CLO-6:	Apply the concepts to generate a latex document with the images from gnu plot and PSPP	2	80	80	H	H	H	H	H	-	-	-	H	H	-	H	-	-	H

Duration (hour)		Module-I (12)	Module- II (12)	Module- III (12)	Module- IV (12)	Module- V (12)
S-1 to 4	SLO-1	Basic commands in Latex: Introduction Program structure, Document class, Preamble, Packages. Programming on Latex document to prepare a letter using report document class	In line math mode, Display math mode, Mathematical symbols Programming on Latex document with mathematical equations.	Programming on Latex document to create a bibliography with .bib file. Programming on latex document to create a Project review 1.	Basics of Gnuplot	PSPP an introduction: Preparation of Data files, Data screening and Transformation
	SLO-2					
S-5 to 8	SLO-1	Programming on Latex document to prepare a bullets and numbering list Programming on Latex document to prepare a table, multi column tables	Programming on Latex document to create a question paper	Type setting the definition, example, theorem, corollary, ,proof, Bibliography, Programming on Latex to create a template for the journal paper.	Working with data in Gnuplot - Plotting styles	Hypothesis Testing
	SLO-2					
S-9 to 12	SLO-1	Programming on Latex document with manipulating the images	Programming on latex document to create a multi choice question paper.	Programming on latex to prepare a beamer presentation	Decorations - Three dimensional plots - Using color for data representation	Descriptives, Frequencies, Graph, Correlation,mean, median, rank, Regression
	SLO-2					

Learning Resources	1. H. Kopkaand P.W. Daly, A Guide to LaTeX, Third Edition, Addison – Wesley, London, 1999. 2. Philipp K. Janert, Gnuplot in Action: Understanding Data with Graphs, 2nd Edition, Manning Publications, 2016. 3. Thomas Williams and Colin Kelley, Gnuplot 5.0 Reference Manual. Samurai Media Limited, 2014.	4. Lee Phillips, gnuplot Cookbook, Packt Publishing, 2012. 5. The PSPP Guide: An Introduction to Statistical Analysis , Christopher P. Halter, II Edition,, CreativeMinds Press Group, 2017.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. M. Radhakrishnan, SRMIST Dr. Rajeev Sukumaran, SRMIST

Course Code	UMA20S04L	Course Name	PYTHON PROGRAMMING	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Understanding the python language construct and apply them for scientific computation	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Apply python vector ,list and plot concept to solve curve fitting	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3 :	Applying Dictionary concept to model Polynomials																		
CLR-4 :	Create insights to difference equation based system model and solving them with python																		
CLR-5 :	Analyze Monte Carlo Simulation for computing Probabilities																		
CLR-6 :	Create insights to the concepts and programming of SciPy, numpy, matplotlib to solve scientific problem																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Apply python language construct to compute formula and scientific problem	2	80	70	H	H	-	-	-	-	-	-	-	-	-	-	-	-	H
CLO-2 :	Analyze Mathematical Models system using f Difference Equations and solving	2	85	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	H
CLO-3 :	Apply time sequence concept for generation and processing of audio signal by python	2	75	70	H	-	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Apply python language construct to solve Polynomials	2	85	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	H
CLO-5 :	Apply python language construct to compute probability by Monte Carlo Simulation ,game design and dynamic random motion creation	2	85	75	H	-	H	-	-	-	-	-	-	-	-	-	-	-	H
CLO-6 :	Apply SciPy, numpy, matplotlib to statistical analysis , correlation coefficient analysis , Solving equations- Linear least squares solutions and signal processing	2	80	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module-V (12)
S-1	SLO-1	Computing with Formulas-Using a Program as a Calculator	Vectors, Mathematical Operations on Vectors, Vector Arithmetics and Vector Function	Reading Data from File- Line by Line, Reading a Mixture of Text and Numbers	Drawing Random Numbers-Uniformly Distributed Random Numbers	SciPy, numpy, matplotlib
	SLO-2	Using Variables, Formatting Text and Numbers	Arrays in Python Programs-Using Lists for Collecting Function Data	Making Dictionaries	Computing the Mean and Standard Deviation	Basic array methods in numpy, Changing the shape of an array
S-2	SLO-1	Celsius-Fahrenheit Conversion,	Curve Plotting-The SciTools and Easyviz Packages	Dictionary Operations	The Gaussian or Normal Distribution- Drawing a Random Element from a List	Maximum and minimum values
	SLO-2	Evaluating Standard Mathematical Functions, Type Conversion	Plotting a Single Curve, Decorating the Plot, Plotting Multiple Curves, Controlling Line Styles	Polynomials as Dictionaries, File Data in Dictionaries, File Data in Nested Dictionaries	Drawing random interger	Reading and writing an array to a fle
S 3-4	SLO-1	Lab 1:programming on formula and Standard Mathematical Functions-Evaluate a Gaussian function, Compute the air resistance on a football	Lab 4: Curve Plotting	Lab 7: reading student marks file into a dictionary data with the student name as key and computing the average grades	Lab 10: real card games	Lab 13: numpy file reading and data analysis
	SLO-2					
S-5	SLO-1	Complex Numbers, Complex Arithmetic's in Python	Numerical Python Arrays manipulations	Strings- Common Operations on Strings	Computing Probabilities-Principles of Monte Carlo Simulation	Statistical methods in numpy
	SLO-2	Input Data-Reading Keyboard Input-Reading from the Command Line	Higher-Dimensional Arrays-Two-Dimensional Numerical Python Arrays	Reading Coordinates	Throwing Dice, Rolling Two Dice game	Statistical methods in numpy
S-6	SLO-1	Making Modules, Collecting Functions in a Module File	Matrix Objects	Reading Data from Web Pages- About Web Pages	Drawing Balls from a Hat	Histograms

	SLO-2	Using Modules	Mathematical Models Based on Difference Equations- Interest Rates	Access Web Pages in Programs- Reading Pure Text Files,	Simple Games- Guessing a Number	Solving equations- Linear least squares solutions- Beer-Lambert Law
S 7-8	SLO-1	Lab 2: program on Making Modules and using them	Lab 5: Animating a Function-temperature on earth	Lab 8:reading web temperature text file into Dictionaries and computing average Temperature	Lab 11: Simple Games	Lab 14: the correlation coefficient between pressure and temperature
	SLO-2					
S-9	SLO-1	while loops and for loops	the Factorial as a Difference Equation	Extracting Data from an HTML Page	Random Walk in One Space Dimension	One-Dimensional Fast Fourier Transforms
	SLO-2	Lists and list manipulation	Growth of a Population, Payback of a Loan, Making a Living from a Fortune	Writing a Table to File, Reading and Writing Spreadsheet Files	Basic Implementation, visualization and Computing Statistics of the Particle Positions	Matplotlib basics- Plotting on a single axes object, scatter plot, Bar charts and pie charts
S-10	SLO-1	Loops with List Indices, Nested Lists	Logistic Growth, Programming with Sound Writing Sound to File, Reading Sound from File,	Representing a Function as a Class and manipulation	Random Walk in Two Space Dimensions	Choosing the Length of the DFT
	SLO-2	Tuples, Functions, Lambda Functions, If Tests	Playing Many Notes	Bank Accounts as class, A Class for Solving ODEs	Basic Implementation, visualization and Computing Statistics of the Particle Positions	Filters in Signal Processing
S 11-12	SLO-1	Lab 3: Programming on list and loops	Lab 6: Sound generated by formula and difference equation	Lab 9: Programming on class	Lab 12: Random Walk in One Space Dimension or Two Space Dimensions	Lab 15: Numpy signal processing
	SLO-2					

Learning Resources	1. Hans Petter Langtangen," A Primer on Scientific Programming with Python", Springer, 2000. 2. Christian Hill, "Learning Scientific Programming with Python", Cambridge University Press, 2015.	3. Juan Nunez-Iglesias, Stéfan van der Walt, and Harriet Dashnow Elegant SciPy Te Art of Scientific Python, O'Reilly Media, 2017.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. M. Radhakrishnan, SRMIST Dr. Rajeev Sukumaran, SRMIST

Course Code	UJK20301T	Course Name	Universal Human Values	Course Category	JK	Life Skill Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning
CLR-1 :	To generate in students a sensitivity to current regional and national issues such as gender marginalization Eco sensitivity, vision for the Nation and general humanness	1
CLR-2 :	An expanded consciousness with a mind to accommodate all is developed	2
CLR-3 :	The ability to accept all and to co- exist is initiated	3
CLR-4 :	To create community connectivity and interdependence	
CLR-5 :	To instill intrinsic link between freedom and responsibility for both individuals and communities	
CLR-6 :	Make them learn the basic nature of human beings	

Program Learning Outcomes (PLO)

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related Disciplines	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize Knowledge	7 Skills in Modeling	8 Analyze, Interpret Data	9 Investigative Skills	10 Problem Solving Skills	11 Communication Skills	12 Analytical Skills	13 PSO -1	14 PSO -2	15 PSO-3
CLO-1 :	Become sensitive toward every living life and be able to respect every religion recognizing the universal values	2	75	60	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-2 :	Every way of life and culture will kindle the curiosity in them to know them and will be able appreciate the beauty in it	2	80	70	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-3 :	The presumptuous or prejudiced mentality will be overcome by them	2	70	65	H	H	H	H		-	-	-	-	-	-	-	-	-	-
CLO-4 :	Critical thinking and accommodative nature will become so natural way of thinking for them	2	70	70	H	H	H	H	H	-	-	-	-	-	H	-	-	-	-
CLO-5 :	They will become aware of the social inequalities and justice	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Will be able to explore their own emotions, hopes & fear and be able to describe them verbally	2	75	70	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Duration (hour)		06	06	06	06	06
S-1	SLO-1	What is love? Forms of love. For self, parents, family, friends, spouse, community, nation, humanity and other beings, both for living and non living	*Love compassion empathy sympathy and non violence*	*Narratives and anecdotes from history, literature including local folklore*	*What will learners lose if they don't practice love and compassion?*	*Sharing learners' individual and/ or group experiences*
	SLO-2	Love and Compassion inter relatedness	*Individuals who are remembered in history for practicing compassion and love*	*Practicing Love and Compassion: what will they gain if they practice compassion?*	*Simulated situations*	Case studies
S-2	SLO-1	*What is Truth ?*	*Universal truth, truth as value, as fact,*	*Veracity, sincerity, honesty among others*	Individuals who are remembered in the history who have practiced these values	Practicing truths
	SLO-2	*: what will they gain if they practice truth*	*What will learners lose if they don't practice truth?*	*Sharing learners' individual and/ or group experiences*	*Simulated situations*	Case studies
S-3	SLO-1	*What is non violence – its need, love compassion,*	*empathy sympathy for others as pre-requisites for non- violence*	**Ahimsa as non violence and non killing**	*Individuals and their organizations which are known for their commitment for non violence*	Narratives and anecdotes about non violence from history and literature including local folklore
	SLO-2	Practicing non violence	*What will they gain if they practice non violence*	*What will learners lose if they don't practice non violence?*	*Simulated situations*	Case studies
S-4	SLO-1	*What is righteousness ?*	*Righteousness and Dharma*	*Righteousness and priority*	Individuals who are remembered in the history	Narratives and anecdotes

					who have practicing righteousness.	about Righteousness from history and literature including local folklore
	SLO-2	Practicing *Righteousness*	*: Sharing learners' individual and/ or group experiences*	*what will learners lose if they don't practice Righteousness*	*Simulated situations*	Case studies
S-5	**SLO-1**	*What is peace?*	*Need of peace in Relation with harmony and balance*	Narratives and anecdotes about peace from history and literature including local folklore	Individuals who are remembered in the history who have practicing peace	Practicing peace
	SLO-2	*What will they gain if they practice peace*	*what will learners lose if they don't practice peace*	*Sharing learners' individual and/ or group experiences*	*Simulated situations*	Case studies
S-6	**SLO-1**	What is service and renunciation	*Forms of service , & renunciation Individuals who have recommended service in history*	*Practicing service and renunciation*	Narratives and anecdotes about Service & renunciation from history and literature including local folklore	Individuals who are remembered in the history who have practicing renunciation
	SLO-2	*Sharing learners' individual and/ or group experiences on renunciation*	*Sharing learners' individual and/ or group experiences on service*	*what will learners lose or gain if they do/don't practice Renunciation and service*	*Simulated situations*	Case studies

Learning Resources	***Theory:*** 1. "Universal Human Values: Text Book"– Compiled and Edited by the Faculty of Science and Humanites, SRMIST, 2020.

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)							
		CLA – 1 (20%)		CLA – 2 (20%)		CLA – 3 (30%)		CLA – 4 (30%) #	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	40%	-	40%	-	40%	-
	Understand								
Level 2	Apply	40%	-	40%	-	40%	-	40%	-
	Analyze								
Level 3	Evaluate	20%	-	20%	-	20%	-	20%	-
	Create								
	Total	100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

Course Code	UMA20401T	Course Name	DISCRETE MATHEMATICS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn about logic, connectives and to understand inference theory																		
CLR-2 :	To gain knowledge about set theory, relations, types of relation, functions and its properties.																		
CLR-3 :	To know about Recurrence relations, Generating functions																		
CLR-4 :	To study about combination, permutation, Inclusion and exclusion and Pigeonhole principle																		
CLR-5 :	To know about Boolean Algebra																		
CLR-6 :	To know about Languages and Automata																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Symbolize the statement problems in propositional calculus and also in predicate calculus	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Identify the type of relations, construct Hasse diagram, solve problems in functions	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Solve both homogeneous and non-homogeneous recurrence relations using particular solution and generating functions	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Discuss group, example, properties, cyclic groups, abelian groups, cosets, Lagrange's theorem, group homomorphism, isomorphism, Normal subgroups	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To know about Boolean Algebra	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	To know about Languages and Automata	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to Propositions	Introduction to Laws of Set Theory	Introduction to Recurrence relations	Introduction to Combinatorics	Introduction to Boolean algebra
	SLO-2	Types of proposition	Solving Problems using Analytical proof	Examples of recurrence relations	Combination	Introduction to Boolean algebra
S-2	SLO-1	**Introduction to connectives**	Solving Problems using	**Homogeneous and non homogeneous recurrence relations**	Permutation	Properties of Boolean algebra
	SLO-2	Types of connectives and truth. Concept of tautologies and contradiction	Introduction to Min Set, Max set and duality	Order or degree of homogeneous and non homogeneous recurrence relations	Problems on combination	Properties of Boolean algebra
S-3	SLO-1	Truth table for compound statements	Concepts of min set forming a partition of a set or not	Solution of homogeneous recurrence relations	**Problems on permutation**	Properties of Boolean algebra
	SLO-2	Introduction to Laws of logic,, equivalences, duality	Introduction to relation, types of relation	Solution of homogeneous recurrence relations	**Problems on combination and permutation**	Properties of Boolean algebra
S-4	SLO-1	Truth table approach for solving equivalences	Problems to show the relation is an equivalence relation	Solution of non-homogeneous recurrence relations using particular solution	**Problems on combination and permutation**	Problems on Boolean algebra
	SLO-2	Solving equivalence problems using laws of logic	Problems to show the relation is an equivalence relation	Solution of non-homogeneous recurrence relations using particular solution	**Problems on combination and permutation**	Properties on Boolean algebra

S-5	SLO-1	Introduction to inference theory	Graphical representation of relations	Solution of non-homogeneous recurrence relations using particular solution	**Problems on combination and permutation**	Introduction to Grammar Languages
	SLO-2	Implications	Construction of Hasse Diagram for a POSET	Solution of non-homogeneous recurrence relations using particular solution	**Problems on combination and permutation**	Introduction to grammar Languages
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Procedure to solve implications using Direct method	Composition of relations	Solution of non-homogeneous recurrence relations using particular solution	Principle of inclusion and exclusion	Problems on L(G)
	SLO-2	Solving implications using Direct Method	Matrix representation of relations	Solution of non-homogeneous recurrence relations using particular solution	Proof of principle of inclusion and exclusion	Problems on L(G)
S-8	SLO-1	Procedure to solve implications using Indirect method	Operation on matrices of two or more relations	Solution of non-homogeneous recurrence relations using particular solution	Problems on inclusion and exclusion	Problems on L(G)
	SLO-2	Solving implications using Indirect Method	Closure operation on relations - Reflexive and symmetric closure on relations	Solution of non-homogeneous recurrence relations using particular solution	Problems on inclusion and exclusion	Problems on L(G)
S-9	SLO-1	Procedure to solve implications using conditional proof method	Transitive closure on relation using Warshall's Algorithm	Formation of recurrence relations from sequence	Problems on inclusion and exclusion	Introduction to FSM
	SLO-2	Solving implications using conditional proof method	Transitive closure on relation using Warshall's Algorithm	Formation of recurrence relations from sequence	Principle of Mathematical Induction	Introduction to FSM
S-10	SLO-1	Procedure to solve implications using inconsistent	Introduction to Functions	Introduction to generating function	Problems on Mathematical induction	Problems on FSM
	SLO-2	Solving implications using inconsistent	Examples to check whether the relation is a function	Introduction to generating function	Problems on Mathematical induction	Problems on FSM
S-11	SLO-1	Introduction to Predicate Calculus.	Types of functions. Verifying whether function is bijective or not	Generating function for standard sequences	Problems on Mathematical induction	Introduction to FSA
	SLO-2	Introduction to types of quantifiers- Universal and Existential	Special types of functions with examples.	Generating function for standard sequences	Problems on Mathematical induction	Introduction to FSA
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Introduction to types of variables - Free and Bound	Composition of functions	Solution of homogeneous recurrence relations using generating functions	Pigeon hole principle	Problems on FSA
	SLO-2	Implications with relevant to predicate Calculus	Composition of functions is associative	Solution of homogeneous recurrence relations using generating functions	Problems using Pigeon hole principle	Problems on FSA
S-14	SLO-1	Implications with relevant to predicate Calculus	Solving problems under composition of functions	Solution of non-homogeneous recurrence relations using generating functions	**Generalized Pigeon hole principle**	Problems on FSA
	SLO-2	Conditions for applying quantifiers.	Derivation of :If f: A$\rightarrow$ B, g: B$\rightarrow$ C are 1-1 and onto functions, then g$\bullet$ f : A $\rightarrow$ C is 1-1 and onto	Solution of non-homogeneous recurrence relations using generating functions	Problems using Generalized Pigeon hole principle	Problems on FSA
S-15	SLO-1	Solving implications in predicate calculus using Direct Method	Introduction to invertible functions.	Solution of non-homogeneous recurrence relations using generating functions	Problems using Generalized Pigeon hole principle	Recognition of regular languages
	SLO-2	Solving implications in predicate calculus using Direct Method	Derivation of The inverse of a function f, if exists, is unique	Solution of non-homogeneous recurrence relations using generating functions	Problems using Generalized Pigeon hole principle	Recognition of regular languages
S-16	SLO-1	Solving implications using Indirect Method	T Derivation of he necessary and sufficient condition for the function f: A$\rightarrow$ B to be invertible is that f is 1-1 and onto	Solution of non-homogeneous recurrence relations using generating functions	Problems using Generalized Pigeon hole principle	Recognition of regular languages

	SLO-2	Solving implications using Indirect Method	Derivation of If f: A→ B, g: B→ C are invertible functions, then g● f : A → C is also invertible and $(g\bullet f)^{-1} = f^{-1} \bullet g^{-1}$.	Solution of non-homogeneous recurrence relations using generating functions	Problems using Generalized Pigeon hole principle	Recognition of regular languages
S-17	SLO-1	Solving implications using conditional proof method	Solving problems under invertible function	Applications of Recurrence relations- Tower of Hanoi problem	Problems using Generalized Pigeon hole principle	Problems on Automata
	SLO-2	Solving implications using conditional proof method	Solving problems under invertible function	Applications of Recurrence relations- Tower of Hanoi problem	Problems using Generalized Pigeon hole principle	Problems on Automata
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Alan Doerr and Kenneth LevAsseur, Apllied Discrete Structures for Computer Science, Galgotia Publications (P) Ltd, 1992. 2. Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Major Core Graw Hill Publishing Co.,35th edition, 2008.	3. Kolmon and Busby, Discrete Mathematical Structures for Computer Science, Prentice Hall, 3rd edition, 1997.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Prof. K. S. Ganapathy Subramanian, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mr. J. Sasi Kumar, SRMIST Mrs. T. Karthy, SRMIST Mrs. D. Thanga Rajathi, SRMIST

Course Code	UMA20D04T	Course Name	FUZZY MATHEMATICS	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To know the basic definitions of fuzzy set theory	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To learn the arithmetic operations involved in fuzzy sets																		
CLR-3 :	To know where to apply the arithmetic operations																		
CLR-4 :	To know the concepts of fuzzy relations and fuzzy logic																		
CLR-5 :	To learnt the fundamentals of Fuzzy Algebra																		
CLR-6 :	To be aware of the applications of Fuzzy sets																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Get exposed to fuzzy sets, fuzzy subsets and their properties	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Will be capable enough to use the arithmetic operations involved in fuzzy sets effectively	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	To have a better understanding of fuzzy logic	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	To be familiar with fuzzy relations and to do problems based on it	3	85	80	H	H		M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To be familiar with the fundamentals of fuzzy algebra	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	To be aware of the applications of fuzzy sets	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to fuzzy sets	Algebraic product of two fuzzy subsets	Introduction to fuzzy relations	Introduction to some more connectives exclusive OR, NAND, NOR	Definition of invariant subgroups
	SLO-2	Basic definitions of fuzzy sets	Problems	Definition of a binary relation	Examples related to it.	Example of invariant fuzzy subgroups
S-2	SLO-1	**Examples of fuzzy sets**	Problems	**Examples based on fuzzy relation**	Brief introduction on two-state devices	Example of invariant fuzzy subgroups
	SLO-2	Examples of fuzzy sets	Problems	Examples on fuzzy binary relation	Real life examples	Proofs of propositions on invariant fuzzy subgroups
S-3	SLO-1	Definition of fuzzy subsets	Algebraic sum of two fuzzy subsets	Introduction to union, intersection of fuzzy relations	**Introduction to fuzzy logic**	Proofs of propositions on invariant fuzzy subgroups
	SLO-2	Examples of fuzzy subsets	Problems	Examples based on it.	Comparing classical logic and fuzzy logic	Proofs of propositions on invariant fuzzy subgroups
S-4	SLO-1	Definition of partially ordered sets	Problems	Definition of algebraic sum and algebraic product of fuzzy relations.	**Introducing logical connectives in fuzzy logic**	Proofs of propositions on invariant fuzzy subgroups
	SLO-2	Examples based on it	Properties of fuzzy subsets	Relevant Examples	**Approximate reasoning of fuzzy logic**	Proofs of propositions on invariant fuzzy subgroups
S-5	SLO-1	Types of fuzzy sets	Proofs of properties	Some more examples	**Concept of fuzzy tautologies, equivalence and contradiction**	Proofs of propositions on invariant fuzzy subgroups
	SLO-2	Examples of fuzzy sets	Proofs of properties	Some more examples	Relevant examples	Proofs of propositions on invariant fuzzy subgroups

S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Definition of a poset and lattices	Definition of fuzzy subset function	Introduction to composition and complement of fuzzy relations	Introduction to fuzzy subgroupoids	Definition of fuzzy quotient group
	SLO-2	Examples based on it	Illustration based on it	Relevant examples	Theorems on subgroupoids	Example
S-8	SLO-1	Introduction to Boolean Algebra	Theorems on fuzzy set functions	Similarity relation	Theorems on subgroupoids	Proofs of propositions on fuzzy quotient group
	SLO-2	Identities based on it	Theorems	Example explaining similarity relation.	Introduction to lattice of fuzzy subgroupoids	Proofs of propositions on fuzzy quotient group
S-9	SLO-1	Definition of L-fuzzy sets	Theorems and their proofs	Introduction to fuzzy preorder relation and fuzzy partial order relation	Theorems on lattice of fuzzy subgroupoids	Proofs of propositions on fuzzy quotient group
	SLO-2	Examples	Theorems and their proofs	Examples relating to it	Theorems on lattice of fuzzy subgroupoids	Proofs of propositions on fuzzy quotient group
S-10	SLO-1	Visual representation of a fuzzy subset	Cartesian product of fuzzy subsets	Introduction to classical logic	**Definition of homomorphic image of a subgroupoid**	Proofs of propositions on fuzzy quotient group
	SLO-2	Operations on fuzzy subsets	Cartesian product of fuzzy subsets	Discussion of statements and sentences	Pre-image of a subgroupoid	Proofs of propositions on fuzzy quotient group
S-11	SLO-1	Problems based on operations	Vector sum of fuzzy subsets	Introduction	Property based on it	Proofs of propositions on fuzzy quotient group
	SLO-2	Problems	Scalar multiplication of fuzzy subsets	Different types of connectives	Property based on it	Proofs of propositions on fuzzy quotient group
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Definition of level set	Propositions based on it	Examples and problems related to connectives.	Proofs of proposition of homomorphic image of a fuzzy subgroupoid	Definition of fuzzy subrings
	SLO-2	More on level sets	Propositions and their proofs	Some more examples	Proofs of propositions	Examples
S-14	SLO-1	**Properties of fuzzy subsets of a set**	Propositions and their proofs	**Discussion of propositional laws relating to logical connectives**	**Definition of fuzzy subgroups**	Proofs of propositions on fuzzy subrings
	SLO-2	Some more properties	Propositions and their proofs	Definition of a tautology	Theorems involving fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-15	SLO-1	Proofs of properties	Propositions and their proofs	Examples	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
	SLO-2	Proofs of properties	Propositions and their proofs	Examples for dual of two connectives	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-16	SLO-1	Problems	Propositions and their proofs	Introducing functionally complete set of connectives	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
	SLO-2	Problems	Propositions and their proofs	Examples	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-17	SLO-1	**Problems**	Propositions and their proofs	**Examples**	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
	SLO-2	Problems	Propositions and their proofs	Some more examples on connectives	Theorems on fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. S. Nanda and N.R. Das, Fuzzy Mathematical Concepts,Narosa Publishing House, New Delhi, 2010. 2. M. Ganesh, Introduction to Fuzzy Sets and Fuzzy Logic, Prentice Hall of India Pvt. Ltd, 2006. 3. John.N.Mordeson and Premchand S.Nair, Fuzyy Mathematics, Spring verlong, 2001.	4. George J.Klir / Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and A : Theory and Applications, Pretice Hall of India, 1995 5. H.J.Zimmermann, Fuzzy Set Theory and its Applications, Allied publishers Ltd, New Delhi, 2001.

Learning Assessment			
	Bloom's	**Continuous Learning Assessment (50% weightage)**	**Final Examination (50% weightage)**

	Level of Thinking	CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. K. Ganesan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs Melita Vinoliah, SRMIST

Course Code	UMA20D05T	Course Name	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand PDEs and will be able to study about its properties	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To relate the concepts of parabola, elliptic, and hyperbola																		
CLR-3:	Address concepts related to heat equations																		
CLR-4:	To understand concepts of heat and wave equations																		
CLR-5:	To learn the concepts of Laplace transform and properties.																		
CLR-6:	To relate the concepts of dimension of a Fourier transform to PDEs																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Recognize the mathematical ideas of PDEs	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Link the fundamental concepts of PDEs	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Explain the significance of the classification of PDEs	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Analyze consequences of Laplace Transform	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Learn about structure of Laplace between ODE and PDEs	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Know the fundamental concepts in PDEs such as heat, wave, Laplace and Fourier transform.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Classification of PDEs	Introduction to heat equation	Introduction to Laplace transform	Introduction to Fourier transform methods
	SLO-2	Formation of partial differential equation by eliminating arbitrary constants	Classification of PDEs	Solution of one dimensional heat equation	Introduction to Laplace transform	Fourier Integral Representations
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Types of PDEs	Solution of one dimensional heat equation	Transform of Some Elementary Functions	Fourier Integral Representations
	SLO-2	Formation of partial differential equation by eliminating arbitrary functions	Types of PDEs	Boundary conditions	Transform of Some Elementary Functions	Fourier Integral Theorem
S-3	SLO-1	Solution of standard types of first order equations	General formula for all types of PDEs	One dimensional heat equation and its possible solutions	Properties of Laplace Transform	Fourier Integral Theorem
	SLO-2	Solution of standard types of first order equations	General formula for all types of PDEs	One dimensional heat equation and its possible solutions	Properties of Laplace Transform	Sine and Cosine Integral Representations
S-4	SLO-1	Introduction to Cauchy Problems	General formula for all types of PDEs	Steady state conditions and zero boundary conditions-related problems	Transform of a Periodic Function	Sine and Cosine Integral Representations

	SLO-2	Cauchy Problems	Parabolic type	Steady state conditions and zero boundary conditions-related problems	Transform of a Periodic Function	Fourier Transform Pairs
S-5	SLO-1	Solving Types Non-Linear PDE	Parabolic type	Steady state conditions and Non-zero boundary conditions related problems	Transform of Error Function	Fourier Transform Pairs
	SLO-2	Solving Types Non-Linear PDE	Parabolic type problems	Steady state conditions and Non-zero boundary conditions related problems	Transform of Error Function	Transform of Elementary Functions
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Type 1 F(p,q)=0	Elliptic type	Solving one dimensional heat equation	Transform of Bessel's Function	Transform of Elementary Functions
	SLO-2	Type 1 F(p,q)=0	Elliptic type	Solving one dimensional heat equation	Transform of Bessel's Function	Properties of Fourier Trasnform
S-8	SLO-1	Type 2 F(x,p,q) =0;	Elliptic type problems	Method of separation of variables	Transform of Dirac Delta Function	Properties of Fourier Transform
	SLO-2	Type 2 F(x,p,q) =0	Elliptic type problems	Method of separation of variables	Transform of Dirac Delta Function	Convolution Theorem (Faltung Theorem)
S-9	SLO-1	Type 3 F(y,p,q) =0;	Hyperbolic type	One dimensional Wave Equation and its possible solutions	Inverse Transform	Convolution Theorem (Faltung Theorem)
	SLO-2	Type 3 F(y,p,q) =0;	Hyperbolic type problems	One dimensional Wave Equation and its possible solutions	Inverse Transform	Parseval's Relation
S-10	SLO-1	Type 4 F(z,p,q) =0	Hyperbolic type problems	Initial and Boundary value Problems with zero velocity – related problems	Convolution Theorem (Faltung Theorem)	Parseval's Relation
	SLO-2	Type 4 F(z,p,q) =0	Solving homogeneous PDEs	Initial and Boundary value Problems with zero velocity – related problems	Convolution Theorem (Faltung Theorem)	Transform of Dirac Delta Function
S-11	SLO-1	Type 5 F(x,p) =F(y,q);	Basic definition of homogeneous PDEs	Initial and Boundary value Problems with Nonzero velocityrelated problems	Transform of Unit Step Function	Transform of Dirac Delta Function
	SLO-2	Type 5 F(x,p) =F(y,q);	Basic definition of homogeneous PDEs	Initial and Boundary value Problems with Nonzero velocityrelated problems	Transform of Unit Step Function	Multiple Fourier Transforms
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Type 6 Clauirts Equations	Basic property for complementary function	D-Alembert's solution of heat equations	Complex Inversion Formula (Mellin-Fourier Integral)	Multiple Fourier Transforms
	SLO-2	Type 6 Clauirts Equations	Basic property for complementary function	D-Alembert's solution of heat equations	Complex Inversion Formula (Mellin-Fourier Integral)	Finite Fourier Transforms
S-14	SLO-1	Solve problems Type 1	Basic property for particular integral	D-Alembert's solution of heat equations	Solution of Partial Differential Equations	Finite Fourier Transforms
	SLO-2	Solve problems Type 2	Basic property for particular integral	D-Alembert's solution of wave equations	Solution of Partial Differential Equations	Finite Sine Transform
S-15	SLO-1	Solve problems Type 3	Solving Non- homogeneous linear PDEs.	D-Alembert's solution of wave equations	Solution of Diffusion Equation	Finite Sine Transform
	SLO-2	Solve problems Type 4	Basic definition of Non-homogeneous PDEs	D-Alembert's solution	Solution of Diffusion Equation	Finite Cosine Transform
S-16	SLO-1	Solve problems Type 5	Basic property for complementary function	D-Alembert's solution	Miscellaneous Examples	Solution of Laplace Equation
	SLO-2	Solve problems Type 6	Basic property for particular integral	D-Alembert's solution	Miscellaneous Examples	Solution of Laplace Equation

S-17	SLO-1	Applications of basic PDEs	Applications of homogeneous PDEs	Applications of heat equations	Applications of Laplace transforms	Applications of Fourier transform methods
	SLO-2	Applications of basic PDEs	Applications of Non-homogeneous PDEs	Applications of wave equations	Applications of Laplace transforms	Applications of Fourier transform methods
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. T.Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publications, 1st Edition. 2. Sankara Rao, Introduction to Partial Differential Equations, Printice Hall. 3. I. P. Stavroulakis and S. A.Tersian, Partial differential equations- an introduction with mathematica and maple, world - Scientific, Singapore, 1999.	4. I. N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1998. 5. L. C. Evans, Partial Differential Equations, American Mathematical Society, 2010. 6. W. E. Williams, Partial differential equations, Clarendon Press, Oxford, 1980

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr.S. Balamuralitharan, SRMIST

Course Code	UMA20D06T	Course Name	ASTRONOMY	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand Celestial Mechanics and will be able to study about its properties	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To relate the concepts of Spherical Astronomy																		
CLR-3:	Address concepts related to Photometric Concepts and Magnitudes																		
CLR-4:	To understand concepts of Radiation Mechanisms																		
CLR-5:	To learn the concepts of The Solar System and properties.																		
CLR-6:	To relate the concepts of dimension of a Spherical Astronomy																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Recognize the mathematical ideas of Astronomy	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2:	Link the fundamental concepts of Astronomy	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3:	Explain the significance of the classification of Astronomy	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4:	Analyze consequences of Spherical Astronomy	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5:	Learn about structure of Astronomy between Photometric Concepts and Magnitudes	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6:	Know the fundamental concepts in Astronomy such as Solar System and properties.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Introduction to Celestial Mechanics	Introduction to Spherical Astronomy	Introduction to Photometric Concepts and Magnitudes	Introduction to Radiation Mechanisms	Introduction to The Solar System
	SLO-2	Introduction to Celestial Mechanics	Spherical Trigonometry	Introduction to Photometric Concepts and Magnitudes	Introduction to Radiation Mechanisms	Introduction to The Solar System
S-2	SLO-1	**Equations of Motion**	Spherical Trigonometry	**Intensity**	Radiation of Atoms	Planetary Configurations
	SLO-2	Equations of Motion	The Earth	Intensity	Radiation of Atoms	Planetary Configurations
S-3	SLO-1	Solution of the Equation of Motion	The Earth	Flux Density	**Molecules**	Orbit of the Earth
	SLO-2	Solution of the Equation of Motion	The Celestial Sphere	Flux Density	Molecules	Orbit of the Earth
S-4	SLO-1	Equation of the Orbit and Kepler's First Law	The Celestial Sphere	Luminosity	**The Hydrogen Atom**	Visibility of the Sun
	SLO-2	Equation of the Orbit and Kepler's First Law	The Horizontal System	Luminosity	**The Hydrogen Atom**	Visibility of the Sun
S-5	SLO-1	Orbital Elements	The Horizontal System	Apparent Magnitudes	Line Profiles	The Orbit of theMoon
	SLO-2	Orbital Elements	The Equatorial System	Apparent Magnitudes	Line Profiles	The Orbit of theMoon
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Kepler's Second Law	The Equatorial System	Magnitude Systems	Quantum Numbers	Eclipses
	SLO-2	Kepler's Second Law	Rising and Setting Times	Magnitude Systems	Quantum Numbers	Eclipses
S-8	SLO-1	Kepler's Third Law	Rising and Setting Times	Absolute Magnitudes	Selection Rules	Occultations
	SLO-2	Kepler's Third Law	The Ecliptic System	Absolute Magnitudes	Selection Rules	Occultations
S-9	SLO-1	Systems of Several Bodies	The Ecliptic System	Extinction	Population Numbers	The Structure
	SLO-2	Systems of Several Bodies	The Galactic Coordinates	Extinction	Population Numbers	The Structure
S-10	SLO-1	Orbit Determination	The Galactic Coordinates	Optical Thickness	**Molecular Spectra**	Surfaces of Planets
	SLO-2	Orbit Determination	Perturbations of Coordinates	Optical Thickness	Molecular Spectra	Surfaces of Planets
S-11	SLO-1	Position in the Orbit	Perturbations of Coordinates	Examples	Continuous Spectra	Atmospheres
	SLO-2	Position in the Orbit	Perturbations of Coordinates	Examples	Continuous Spectra	Atmospheres
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Escape Velocity	Positional Astronomy	Intensity Photometric Concepts	Blackbody Radiation	Magnetospheres
	SLO-2	Escape Velocity	Positional Astronomy	Intensity Photometric Concepts	Blackbody Radiation	Magnetospheres
S-14	SLO-1	**Virial Theorem**	Constellations	**Flux Density Photometric Concepts**	**Temperatures**	Albedos
	SLO-2	Virial Theorem	Constellations	Flux Density Photometric Concepts	Temperatures	Albedos
S-15	SLO-1	The Jeans Limit	Star Catalogues and Maps	Luminosity Photometric Concepts	Other Radiation Mechanisms	Photometry
	SLO-2	The Jeans Limit	Star Catalogues and Maps	Luminosity Photometric Concepts	Other Radiation Mechanisms	Photometry
S-16	SLO-1	Examples	Calendars	Extinction Photometric Concepts	Radiative Transfer	Polarimetry
	SLO-2	Examples	Examples	Extinction Photometric Concept	Radiative Transfer	Polarimetry
S-17	SLO-1	**Applications of Celestial Mechanics**	**Applications of Spherical Trigonometry**	Applications of Photometric Concepts and Magnitudes	Applications of Radiation Mechanisms	Applications of The Solar System
	SLO-2	Applications of Celestial Mechanics	Applications of Spherical Trigonometry	Applications of Photometric Concepts and Magnitudes	Applications of Radiation Mechanisms	Applications of The Solar System
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Hannu Karttunen, Fundamental Astronomy, Content Technologies Publications, 2013. 2. V.Thiruvenkatacharya, A text book of Astronomy, Schand & Co. Pvt. Ltd., 1972.	3. S. Kumaravelu and Susheela Kumaravelu, Astronomy, SKV Publishers, Nagarkoil, 2004.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										

Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. S. Balamuralitharan, SRMIST

Course Code	UCY20A03J	Course Name	ALLIED CHEMISTRY	Course Category	G	Generic Elective	L	T	P	C
							4	0	4	6

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Chemistry	Data Book / Codes/Standards	NIL		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Make students understand the nature of Chemical Bonding in compounds
CLR-2:	Provide basic knowledge about the chemistry of hydrogen, silicon and other metals
CLR-3:	Make aware of the fuels, fertilizers and other detergents
CLR-4:	Understand the basic principles of chemical kinetics
CLR-5:	Study the concepts in electrochemistry

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		1	2	3	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1:	Gain knowledge on the basic fundamentals in organic chemistry.	2	2	75	H	H	H	H	-	-	-	-	-	-	-	-	H	-	-
CLO-2:	Acquire knowledge about hydrocarbon and their reactions.	2	2	80	-	-	H	-	H	-	-	-	-	-	-	-	H	-	-
CLO-3:	Promote the importance of silicon and metals.	2	2	70	H	H	-	-		-	-	-	-	-	-	-	-	M	-
CLO-4:	Understand the facts in chemical kinetics and photochemistry.	2	2	70	H	H	-	H	H	H	-	-	-	-	-	-	H	M	-
CLO-5:	Understand the basic concepts in industrial chemistry	2	2	80	H	-	H	-	H	-	-	-	-	-	-	-	H	-	-
CLO-6:	Acquire knowledge in the principles of electrochemistry	2	2	75	H	-	-	-	-	-	-	-	-	-	-	-	H	M	-

		Learning Module 1	Learning Module 2	Learning Module 3	Learning Module 4	Learning Module 5
Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction of Hybridisation and Isomerism: Hybridisation - sp, sp^2 and sp^3	Chemical Kinetics:Rate of reaction	Gobar gas and natural gas	Chelation	Electrochemistry: Faradays laws of electrolysis
	SLO-2	Bond length- bond angle- dipole moment	order- molecularity		Industrial applications	
S-2	SLO-1	inductive effect- mesomeric effect and hyperconjucation	first order rate law and simple problems	Fertilizers –NPK and mixed	Industrial Chemistry: Hardness of water – Temporary and permanent hardness	Specific conductance, equivalent conductance
	SLO-2	Isomerism- geometrical and optical isomerism	Half-life period of first order reaction	soaps and detergents.	disadvantages of hard water	Cell constant
S-3	SLO-1	optical activity- asymmetry- dissymmetry	pseudo first order reaction	Carbohydrates, Benzene and Heterocyclic Compounds:Classification of carbohydrates	Boiler scales and sludges	Arrhenius theory of electrolytic dissociation
	SLO-2	elements of symmetry- R, S notations.	zero and second order reactions			Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution
S-4 TO S-8	SLO-1	LAB INTRODUCTION	Estimation of FAS using standard oxalic acid	Estimation of Zn/Mg	Estimation of $K_2Cr_2O_7$ using decinormal solution of Sodium thiosulphatesolution	Determination of Molecular Weight of a Polymer
	SLO-2					

S-9	SLO-1	Hydrocarbons: Methods of preparation of alkanes	Arrhenius and collision theories	Properties and uses of glucose and fructose	Softening of hard water – Zeolite process	Ostwald"s dilution law
	SLO-2	Properties - Reactions		Mutarotation	demineralization process	Kohlrausch law of independent migration of ions
S-10	SLO-1	Free radical mechanism of halogention of alkanes	Arrhenius and collision theories	Chemistry of benzene	reverse osmosis	Nernst equation
	SLO-2	Methods of preparation of alkenes	Arrhenius and collision theories	Preparation	Purification of water for domestic use	Standard electrode (reduction) potential and its application to different kinds of half-cells.
S-11	SLO-1	Stereochemistry of dehydrohalogenation (E1, E2, E1CB mechanism)	Industrial Chemistry:Introduction-Fuel gases	Mechanism of electrophilic substitution reactions	use of Chlorine	
	SLO-2	Properties of alkenes, Electrophilic and nucleophilic addition mechanisms.		Mechanism of electrophilic substitution reactions	Ozone and UV light	
S-12 TO S-15	SLO-1	Estimation of NaOH using standard	Estimation of FAS using standard potassium dichromate	Estimation of ascorbic acid	Estimation of Copper using decinormal solution of Potassium dichromate solution	Conductometric Titrations- II (KClvs $AgNO_3$)
	SLO-2	sodium carbonate				
S-16 TO S-20	SLO-1	Estimation of HCl using standard oxalic acid	Estimation of $KMnO_4$using standard potassium dichromate	Estimation of phenol / aniline	Estimation of Nickel using decinormal solution of EDTA	Potentiometric Titration (Redox Titrations)
	SLO-2					
S-21	SLO-1	Chemistry of Hydrogen, Silicon and Metals: Occurrence- extraction of iron- cobalt- nickel and copper	Water gas	Heterocyclic compounds– Preparation of pyrrole and pyridine.	Phase Rule and Adsorption: Phase rule- Definition of terms involved	Electromotive force of a cell and its measurement
	SLO-2			Propertiesofpyrrole and pyridine.		
S-22	SLO-1	chemical properties of iron- cobalt- nickel and copper		Coordination Chemistry:Nomenclature and isomerism of coordination compounds	phase diagram of H_2O	Nernst equation; Standard electrode (reduction) potential
	SLO-2				phase diagram of Pb-Ag	
S-23	SLO-1	atomic hydrogen and isotopes of hydrogen	producer gas	EAN rule	Adsorption - Langmuir adsorption isotherms	Nernst equation application to different kinds of half-cells
	SLO-2	Preparation and structure of borazole		VB Theory		
S-24	SLO-1	Preparation and structure of borazole	LPG gas	Crystal field theories of octahedral, tetrahedral and square planar complexes	Principles of chromatography (Paper, TLC and column).	Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants
	SLO-2	SiO_2, SiC and $SiCl_4$				

Learning Resources	Theory 1. R. Gopalan, Text Book of Inorganic Chemistry, 2nd edition, Hyderabad, Universities Press, (India), 2012. 2. R.T. Morrison and R.N. Boyd, S. K. Bhattacharjee, Organic Chemistry, 7th edition, Pearson India, 2011. 3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 35th edition, New Delhi ShobanLalNagin Chand and Co, 2013.	Practicals 1. V.Venkateswaran, R.Veeraswamy, A.R.Kulandaivelu, *Basic Principles of Practical Chemistry*, 2nd edition, Sultan Chand and Sons, 1997. 2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*, 5th edition, Pearson Education, 2005.

Learning Assessment

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

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

1. Dr. SudarshanMahapatra, EncubeEthicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. S. Rajeswari, SRMIST*
2. Dr. ShanmukhaprasadGopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. T.Pushpa Malini, SRMIST*

Course Code	UMI20S01L	Course Name	My India Project	Course Category	S	Skill Enhancement course	L	T	P	C
							0	0	0	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department		*Computer Applications*	Data Book / Codes/Standards	*Nil*	

Assessment Method – Fully Internal

Assessment Tools	Marks
Review – I (Activities)	50
Review – II (Project report and Presentation)	50
Total	100

Course Code	UMA20S05L	Course Name	Mathematical Software- MATLAB	Course Category	S	Skill Enhancement course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1:	Exploit the numerical manipulation towards scientific advancement using MATLAB	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Employ various numerical methods in MATLAB	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-3:	Address the concepts related to numerical techniques																		
CLR-4:	Gain the knowledge on how to use MATLAB for scientific computations																		
CLR-5:	Identify the methodology for applying computational methods in MATLAB																		
CLR-6:	Utilize the basic mathematical principles applied in various scientific problems and identify appropriate solutions using MATLAB																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Remembering the knowledge of numerical methods by adopting MATLAB	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2:	Perceive the importance of MATLAB and its usage to solve mathematical problems	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Understand the concept of various numerical techniques	2	70	65	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Basic computations using the functions and variables of MATLAB	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	Understand the importance and application of computations	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Utilize concepts in mathematics for scientific advancements based on the level of perception	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1 to S-4	SLO-1	Basic Exercises in MATLAB	Solution of algebraic and transcendental equations: Bisection method	Solution of Linear Equations-direct methods: Matrix inversion method	Least squares line and curve fitting	Solution of Ordinary Differential Equations using built-in ODE solver
	SLO-2	Basic Exercises in MATLAB	Solution of algebraic and transcendental equations: Bisection method	Solution of Linear Equations-direct methods: Matrix inversion method.	Least squares line and curve fitting	Solution of Ordinary Differential Equations using built-in ODE solver
S-5 to S-8	SLO-1	Using MATLAB as a calculator- Creating vectors and Matrices	Solution of algebraic and transcendental equations: Regula-Falsi method	Solution of Linear Equations-direct methods: Gaussian Elimination method	Interpolation	Solution of Ordinary Differential Equations using Euler and R-K Methods
	SLO-2	Using MATLAB as a calculator- Creating vectors and Matrices	Solution of algebraic and transcendental equations: Regula-Falsi method	Solution of Linear Equations-direct methods: Gaussian Elimination method.	Interpolation	Solution of Ordinary Differential Equations using Euler and R-K Methods
S-9 to S-12	SLO-1	Generating Fibonacci Sequence using if-condition, for loop and while loop	Solution of algebraic and transcendental equations: Newton Raphson methods.	Solution of Linear Equations-direct methods: Gauss-Seidel method.	Constructing and plotting given polynomials and functions	Comparison of Euler, R-K Method and built-in ode solver
	SLO-2	Generating Fibonacci Sequence using if-condition, for loop and while loop	Solution of algebraic and transcendental equations: Newton Raphson methods.	Solution of Linear Equations-direct methods: Gauss-Seidel method	Constructing and plotting given polynomials and functions	Comparison of Euler, R-K Method and built-in ode solver

Learning Resources	1. Tobin A. Driscoll, Learning MATLAB, Society for Industrial and Applied Mathematics (SIAM), 1969. 2. Andrew Knight, Basics of MATLAB and Beyond, CHAPMAN & HALL/CRC, 2000.	3. Brian R. Hunt Ronald L. Lipsman Jonathan M. Rosenberg with Kevin R. Coombes, John E. Osborn, and Garrett J. Stuck, A Guide to MATLAB for Beginners and Experienced Users, Cambridge University Press, 2001.

Learning Assessment												
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**

Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. S. Athithan, SRMIST

Course Code	UMA20S06L	Course Name	Mathematical Software–SCILAB	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1:	Exploit the numerical manipulation towards scientific advancement using Scilab	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Employ various numerical methods in Scilab	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-3:	Address the concepts related to numerical techniques																		
CLR-4:	Gain the knowledge on how to use Scilab for scientific computations																		
CLR-5:	Identify the methodology for applying computational methods in Scilab																		
CLR-6:	Utilize the basic mathematical principles applied in various scientific problems and identify appropriate solutions using Scilab																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Remembering the knowledge of numerical methods by adopting Scilab	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2:	Perceive the importance of Scilab and its usage to solve mathematical problems	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Understand the concept of various numerical techniques	2	70	65	H	-	-		-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Basic computations using the functions and variables of Scilab	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	Understand the importance and application of computations	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Utilize concepts in mathematics for scientific advancements based on the level of perception	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1 to S-4	SLO-1	Basic Exercises in Scilab	Solution of algebraic and transcendental equations: Bisection method	Solution of Linear Equations-direct methods: Matrix inversion method	Least squares line and curve fitting	Solution of Ordinary Differential Equations using built-in ODE solver
	SLO-2	Basic Exercises in Scilab	Solution of algebraic and transcendental equations: Bisection method	Solution of Linear Equations-direct methods: Matrix inversion method.	Least squares line and curve fitting	Solution of Ordinary Differential Equations using built-in ODE solver
S-5 to S-8	SLO-1	Using Scilab as a calculator- Creating vectors and Matrices	Solution of algebraic and transcendental equations: Regula-Falsi method	Solution of Linear Equations-direct methods: Gaussian Elimination method	Interpolation	Solution of Ordinary Differential Equations using Euler and R-K Methods
	SLO-2	Using Scilab as a calculator- Creating vectors and Matrices	Solution of algebraic and transcendental equations: Regula-Falsi method	Solution of Linear Equations-direct methods: Gaussian Elimination method.	Interpolation	Solution of Ordinary Differential Equations using Euler and R-K Methods
S-9 to S-12	SLO-1	Generating Fibonacci Sequence using if-condition, for loop and while loop	Solution of algebraic and transcendental equations: Newton Raphson methods.	Solution of Linear Equations-direct methods: Gauss-Seidel method.	Constructing and plotting given polynomials and functions	Comparison of Euler, R-K Method and built-in ode solver
	SLO-2	Generating Fibonacci Sequence using if-condition, for loop and while loop	Solution of algebraic and transcendental equations: Newton Raphson methods.	Solution of Linear Equations-direct methods: Gauss-Seidel method	Constructing and plotting given polynomials and functions	Comparison of Euler, R-K Method and built-in ode solver

Learning Resources	
	1. Eike Rietsch, An Introduction to Scilab from a Matlab User's Point of View Version 2.6-1.0, 2001, 2002. 2. Nino Boccara - Modeling and Simulation in Scilab_Scicos with ScicosLab 4.4-Springer (2005) (Graduate Texts in Contemporary Physics) 3. Hema Ramachandran, Achuthsankar S. Nair, SCILAB (A free Software to MATLAB), S. Chand & Company Ltd., First Edition, 2012. 4. Steven C.Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Tata Major Core Graw Hill Publishing Company Ltd., 2007. 5. Karan Arora , Kush Garg and Santosh Kumar, Scilab Textbook Companion for Higher Engineering Mathematics by B. S. Grewal, 2016.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%		30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%		40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%		30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	*Dr. A. Govindarajan, SRMIST* Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. S. Athithan, SRMIST

Course Code	UJK20401T	Course Name	Professional Skills	Course Category	Jeevan Kaushal-JK	Life Skill Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)															
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	expose students to the requirements of job market	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLR-2 :	develop resume building practice																		
CLR-3 :	increase efficiency in speaking during group discussions																		
CLR-4 :	prepare students for job interviews																		
CLR-5 :	instill confidence in students and develop skills necessary to face audience																		
CLR-6 :	develop speaking and presentation skills in students																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	understand the importance of resume preparation and build resume	3	80	70	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-2 :	acquire group discussion skills	3	85	75	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-3 :	face interviews confidently	3	85	80	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-4 :	Ask appropriate questions during an interview	3	85	80	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-5 :	understand various types of presentation and use presentation skills in projects	3	85	80	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-6 :	build confidence during any presentation	3	85	80	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Introduction of resume and its importance	Meaning and methods of group discussion	Meaning and types of interview (face to face, telephonic, video)	Types - Informative, Instructional, Arousing, Persuasive, Decision-making	PowerPoint presentation– body language and stage etiquettes
	SLO-2	Difference between a CV, Resume and Bio Data	Procedure of group discussion	Dress code, background research	Structure of a presentation – Introduction of the event, Introducing the speaker, vote of thanks	PowerPoint presentation– body language and stage etiquettes
S-2	SLO-1	Essential components of a good resume, common errors people make while preparing a resume	Group discussion – simulation	STAR Technique (situation, task, approach and response) for facing an interview	Working with audience – ice-breaking, Creating a 'Plan B',	PowerPoint presentation– practice session
	SLO-2	Resume building format	Group discussion – common errors	Interview procedure (opening, listening skills, closure, asking questions)	Getting the audience in the mood, working with emotions,	PowerPoint presentation– practice session
S-3	SLO-1	Resume building using templates	Group discussion – types – Topic based	Important questions generally asked in an interview	Improvisation and unprepared presentations, man-woman view, feedback – appreciation and critique	PowerPoint presentation– practice session
	SLO-2	Resume building using templates	Group discussion – types – Case study based	Important questions generally asked in an interview	Improvisation and unprepared presentations, man-woman view, feedback – appreciation and critique	PowerPoint presentation– practice session
S-4	SLO-1	Resume building activity	Group discussion – practice session- Topic based	Mock interview – face to face	Power point presentation, skit, drama, dance, mime, short films and documentary – Dos and Don'ts	PowerPoint presentation– practice session
	SLO-2	Resume building activity - Feedback	Group discussion - Feedback	Mock interview- Feedback	Power point presentation, skit, drama, dance, mime, short films and documentary – Dos and Don'ts	PowerPoint presentation– practice session

S-5	SLO-1	*Video resume – Tips and tricks*	*Group discussion – practice session- Topic based*	*Mock interview - face to face*	*PowerPoint presentation – content preparation*	*PowerPoint presentation– practice session*
	SLO-2	*Video resume – Do's and Don'ts*	*Group discussion - Feedback*	*Mock interview - Feedback*	*PowerPoint presentation– logical arrangement of content*	*PowerPoint presentation– practice session*
S-6	SLO-1	*Video resume – Templates*	*Group discussion – practice session- Case study based*	*Mock interview - face to face*	*PowerPoint presentation– using internet source, citations, bibliography*	*PowerPoint presentation– practice session*
	SLO-2	*Video resume – Templates*	*Group discussion - Feedback*	*Mock interview- Feedback*	*PowerPoint presentation– using internet source, citations, bibliography*	*PowerPoint presentation– practice session*

Learning Resources	1. *Scott Bennett, The Elements of Resume Style: Essential Rules for Writing Resumes and Cover Letters That Work, AMACOM, 2014* 2. *David John, Tricks and Techniques of Group Discussions, Arihant, 2012* 3. *Singh O.P., Art of Effective Communication in Group Discussion and Interview, S Chand & Company, 2014*	*4. Paul Newton, How to deliver a presentation ; e-book* *5.Eric Garner, A-Z of Presentation, Eric Garner and Ventus Publishing ApS, 2012, bookboon.com*

Learning Assessment					
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**			
		CLA-1 (20%)	**CLA-2 (20%)**	**CLA-3 (30%)#**	**CLA-4 (30%) ##**
		Theory	**Theory**	**Theory**	**Theory**
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	**100 %**	**100 %**	**100 %**	**100 %**

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.
CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Mr Priyanand, Assistant Professor, CDC, E&T, SRMIST* *2. Ms Sindhu Thomas, Head in charge, CDC, FSH, SRMIST* *3. Ms Mahalakshmi, Assistant Professor, CDC, FSH, SRMIST*

Course Code	UMA20501T	Course Name	Algebraic Structures	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To understand groups and will be able to study about its properties.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To understand the concepts of cosets, normal subgroups, and factor groups.																		
CLR-3 :	To relate the concepts of homomorphism, isomorphism and automorphism.																		
CLR-4 :	To understand concepts of Ring and ideals																		
CLR-5 :	To learn the concepts of field and integral domain.																		
CLR-6 :	Learn in detail about polynomial rings.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Recognize the mathematical objects called groups	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Link the fundamental concepts of groups	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Explain the significance of the notions of cosets, normal subgroups and factor groups	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Analyze consequences of Lagrange's theorem	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Learn about structure preserving maps between groups and their consequences	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Apply the fundamental concepts in ring theory such as ideals, quotient rings, integral domains and fields.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Group-Definition, examples.	Normal subgroups	Ring-Definition, examples.	Ideals-Definition, examples	Quotient rings-Definition, examples
	SLO-2	Group-Simple Properties.	Properties and problems based on normal subgroup	Ring-Simple Properties.	Ideals-Simple Properties.	Properties of quotient rings
S-2	SLO-1	Properties based on Group.	Properties of cosets based on normal subgroup	Theorems and problems based on Ring.	Problems on ideals	Prime ideals, Principal ideals
	SLO-2	Order of a Group	Properties of cosets based on normal subgroup	Special classes of rings	Theorems on ideals	Maximal ideals
S-3	SLO-1	Order of an element in a group	Simple groups	Homomorphism of rings	More theorems based on ideals.	Theorems based on prime ideals
	SLO-2	Theorems based on group	Properties based on simple groups	Theorems based on homomorphism of rings.	Sum of two ideals	Theorems based on principal ideals
S-4	SLO-1	Subgroups	Quotient group	Quotient Ring-Definition, examples.	Product of two ideals	Theorems based on maximal ideals
	SLO-2	Properties of subgroups	Properties and problems based on Quotient group	Quotient Ring-Simple Properties.	Examples for left ideal but not a right ideal	Theorems based on maximal ideals
S-5	SLO-1	Cyclic groups	Cauchy's theorem for finite abelian groups	Commutative rings	Examples for right ideal but not a left ideal	Relation between integral domain and field
	SLO-2	Properties of cyclic groups	Cauchy's theorem for finite abelian groups	Examples for commutative rings	Homomorphism of rings.	Relation between integral domain and field
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Generators of a cyclic group	Centralizer of a group	Zero divisors	Properties of homomorphism of a ring	Euclidean rings
	SLO-2	Number of generators of a cyclic groups	Normalizer of a group	Examples of zero divisors.	More theorems based on homomorphism of rings	Properties of Euclidean rings
S-8	SLO-1	Cosets	Centre of a group	Integral domain	More theorems based on homomorphism of rings	Wilson theorem

	SLO-2	Partitioning of a group by Cosets	Properties for centralizer, Normalizer and centre of a group	Properties of integral domain	Isomorphism of rings	Fermat's theorem
S-9	SLO-1	Lagrange's theorem	Product of two subgroups	Division ring	Theorems based on isomorphism of rings	Polynomial rings
	SLO-2	Euler's phi function	Classification of subgroups of cyclic groups	Examples of division ring	Fundamental theorem of ring homomorphism	Properties of polynomial rings
S-10	SLO-1	Euler's theorem	Cycle notation for permutations	Field	First theorem of isomorphism	The division algorithm
	SLO-2	Euler's theorem	Properties of permutations	Field-simple properties	Embedding of rings	Problems based on division algorithm
S-11	SLO-1	Fermat's theorem	Even and odd permutations	Theorems based on field	Embedding of a ring into a ring with unity	Polynomial rings over rational field
	SLO-2	Fermat's little theorem	Even and odd permutations	Theorems based on integral domain	Embedding of a ring into a ring with unity	Polynomial rings over rational field
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Practice problems for groups	Alternating groups	Subrings	Endomorphism of a rings	Gauss Lemma
	SLO-2	Practice problems for groups	Problems for alternating groups	Sum of two subrings	Embedding of a ring into a ring endomorphism	Eisenstein's criterion
S-14	SLO-1	Practice problems for subgroups	Cayley's theorem	Theorems and problems based on subrings.	Practice problems for ideals	Problems based on Eisenstein's criterion
	SLO-2	Practice problems for subgroups	Applications of Cayley's theorem	Centre of the ring	Practice problems for homomorphism of ideals	Euclidean Domain
S-15	SLO-1	Practice problems for cyclic groups	Group homomorphisms	Centre of a quaternion ring	Practice problems for homomorphism of ideals	Theorems based on Euclidean domain
	SLO-2	Practice problems for cyclic groups	Properties of homomorphism	Characteristic of a ring	Comaximal ideals	Prime and irreducible elements
S-16	SLO-1	Permutation group	Group isomorphisms	Properties of characteristic of a ring	Properties of comaximal ideals	Principal ideal domain
	SLO-2	Problems for groups	Properties of isomorphisms	Symmetry Group-Simple Properties.	More on ideals	Theorem based on principal ideal domain
S-17	SLO-1	Quaternion groups.	First isomorphism theorems for groups	Product of two rings	More on ideals	Unique Factorization domain
	SLO-2	Problems for quaternion groups	Second isomorphism theorems for groups	Product of two rings	More on ideals	Theorem based on unique factorization domain
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. I. N. Herstein (2006). Topics in Algebra (2nd edition). Wiley India. 2. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson. 3. Joseph A. Gallian (2017). Contemporary Abstract Algebra (9th edition). Cengage. 4. N. S. Gopalakrishnan (1986). University Algebra, New Age International Publishers.	5. P. B. Bhattacharya, S. K. Jain & S. R. Nagpaul (2003). Basic Abstract Algebra (2nd edition). Cambridge University Press. 6. David S. Dummit & Richard M. Foote (2008). Abstract Algebra (2nd edition). Wiley. 7. Thomas W. Hungerford (2004). Algebra (8th edition). Springer. 8. Serge Lang (2002). Algebra (3rd edition). Springer-Verlag.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. K. Ganesan, SRMIST

	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. R. Perumal, SRMIST Dr. R. Arulprakasam, SRMIST

Course Code	UMA20502T	Course Name	Real Analysis	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	Exploit various number systems in detail and establish the importance of real number system	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	Employ various techniques for a detail analysis of real number system																		
CLR-3:	Introduce the concept of metric space and the norm																		
CLR-4:	Understand the role of continuous functions																		
CLR-5:	Address the concept of derivatives																		
CLR-6:	Introduce integration in real number system																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Gain an insight on real and complex fields	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-2:	Be familiar with metric spaces and various kinds	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Define some topologies	2	75	60	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Classify the role of continuous functions and uniformly continuous functions	2	70	70	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5:	Apply the derivatives in Taylor series expansion of various functions	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Characterize those functions which are Reimann-Stieltjes inegrable	2	75	65	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction- Review of N, W, Z, Q number systems	Function – definition; types	Limit of a function	Definition of derivatives	Higher order derivatives
	SLO-2	Illustration of irrationals not belonging to Q	Injective, surjective and bijective functions – examples	Uniqueness of limit of function in a metric space	Derivatives of elementary functions	Leibniz formula
S-2	SLO-1	Solution for $p^2-2=0$ does not exist in Q	Finite and infinite sets	Algebra of limits of function	Differentiability leads to continuity	Taylor's theorem
	SLO-2	Illustration for $p^2-5=0$.	Examples and basic results	Examples of algebra of limits of function	Example and counterexample	Taylor's expansion of some functions
S-3	SLO-1	Ordered set; Cartesian product of sets	Countable and uncountable sets	Continuous function	Sum of differentiable functions is differentiable	Problems based on higher order derivatives
	SLO-2	Law of trichotomy and illustration	Every infinite subset of countable set is countable	Continuity of elementary functions	Illustrating with examples and counterexamples	Solution to problems
S-4	SLO-1	Bounded above and bounded below	Basic set operations	Composition of continuous functions	Product rule – proof and example	Differentiation of vector-valued functions
	SLO-2	Determining upper and lower bound for R and secondary level sets	Illustrations	Illustration with examples	Quotient rule – proof and example	Illustration with examples
S-5	SLO-1	Least upper and greatest lower bounds	Countable union of countable sets is countable	Characterization for continuous functions	Chain rule	Consequence of mean value theorem in vector valued functions
	SLO-2	Determining LUB and GLB for subsets of R	Proof and consequences	Illustration with examples	Application of chain rule	Proof
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	LUB property of R	Q is countable	Algebra of continuous functions	Local maxima and local minima	Partition of an interval
	SLO-2	Application of LUB property	Set of infinite binary sequences is uncountable	Illustration of algebra of continuous functions	Illustrating examples	Example and properties

S-8	SLO-1	Binary operation on a nonempty set	Metric space – definition	Continuous function on Euclidean space R^k	First derivative test	Riemann integral of a function over an interval
	SLO-2	(F,+) and (F,*) are abelian groups	Examples- discrete metric and usual metric	Algebra of continuous function on R^k	Proof and critical or stationary points	Definition – upper and lower Riemann integrals
S-9	SLO-1	Field – ordered field	Open ball, closed ball, convex set; open and closed set, limit point, perfect and dense set, closure of set	Bounded function	Second derivative test	Function f is Riemann integrable
	SLO-2	Q and R are fields	Examples and proof of balls are convex.	Example and counterexample	Proof and application for maxima/minima	Examples and counterexamples
S-10	SLO-1	Properties of ordered field	Every neighbourhood is open; every neighbourhood of a limit point contains infinitely many points of the set	Continuity and compactness	Generalized mean value theorem	Riemannn Stieltjes integral
	SLO-2	Some basic proofs on properties of ordered field	Set is open iff its complement is closed; union and intersection of open and closed sets	Continuous image of a compact set is compact	Proof and illustration	Definition, examples
S-11	SLO-1	Archimedian property of R	Open relative and some basic theorems	Upper and lower bounds of continuous function on a compact set	Lagrange's Mean value theorem	Riemann integral is special case of Riemann-Stieltjes integral
	SLO-2	Application of Archimedian property	Open cover, subcover, finite subcover, compact set	Supremum and infimum of continuous function on a compact set	Proof	Illustrative examples
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Q is dense in R	K is compact relative to X iff it compact relative to any compact subset of X.	Uniformly continuous function	Application to Mean value theorem	Refinement, Common refinement
	SLO-2	Z is not dense in R	Compact subsets of metric space are closed; closed subset of compact set is closed; some results on intervals	Continuous function on a compact set is uniformly continuous	Problems based on Mean value theorem	The sup and inf values increase on a refinement - Proof and consequences
S-14	SLO-1	Existence of unique n^{th} root of positive real number	K-cell	Continuous image of connected set is connected	Differentiability	Necessary and sufficient condition for a function to be Reimann-Stieltjes inegrable
	SLO-2	Proof and illustration	Every k-cell is compact	Intermediate value theorem	Illustrating examples	Proof
S-15	SLO-1	Extended R; Complex field	Heine-Borel theorem	Discontinuity of a function	Monotonicity	Consequences of the above characterization result
	SLO-2	Properties	Equivalence statements	Kind of discontinuities – examples	Illustrating examples	Examples and counterexamples
S-16	SLO-1	Schwarz inequality	Weierstrass Theorem	Monotonic functions - Monotonic functions have no second kind of discontinuities	Intermediate value theorem for derivatives	Continuous function on an interval is always Riemann Stieltjes integrable
	SLO-2	Normalization technique and proof of Schwarz inequality	Every nonempty perfect set in R^k is uncountable	Monotonic functions have atmost countable discontinuities	Proof and consequences	The condition on a monotonic function to be Riemann Stieltjes integrable
S-17	SLO-1	Euclidean space	Cantor set	Infinite limits and limits at infinity	L'Hospital rule	If f is Riemann Stieltjes integrable and g is continuous, then their composition is Riemann Stieltjes integrable.
	SLO-2	Some basic results	Connected Set – every interval in R is connected	Illustrating examples	Proof and application	Proof
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Walter Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw–Hill Publications, Singapore, Reprint 2012. 2. Tom M. Apostol, Mathematical Analysis, 2nd edition, Pearson, Narosa Publishing House, New Delhi, 2002. 3. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1970. 4. Sterling K.Berberian, Fundamentals of Real Analysis, Springer India Pvt. Ltd., 2013. 5. Royden, H.L., Real Analysis, The Macmillan Company, New York, 2001. 6. R. G. Bartle, D.R. Sherbert, Introduction to Real Analysis, 4e, John Wiley & Sons, 2011.

Learning Assessment						
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**				**Final Examination (50% weightage)**
		CLA – 1 (10%)	**CLA – 2 (10%)**	**CLA – 3 (20%)**	**CLA – 4 (10%)#**	

		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. V. Subburayan, SRMIST Dr. A. Anuradha, SRMIST

Course Code	UMA20D07T	Course Name	Graph Theory	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To introduce the students to the beautiful and elegant theory of graphs	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To equip the students with problem solving, critical, thinking and algorithm techniques that may be used to solve a host of problems in other fields																		
CLR-3:	To understand the concepts of Eulerian and Hamiltonian graphs and their applications in solving real life problems																		
CLR-4:	To understand the concept of colouring in graphs																		
CLR-5:	To address the planarity of graphs																		
CLR-6:	To enable the students to apply graph theoretical techniques to solve problems in other fields.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Gain an insight on the interesting filed of graph theory and its essential parameters	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Analyze the concept of connectivity and cycles	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Be thorough with trees and spanning trees	2	75	60	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Know the importance of Eulerian and Hamiltonian graphs	2	70	70	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Understand the concept of planarity and its applications	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Be familiar with colouring of graphs and its criticality	2	75	65	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to the subject	Matrix representation of graphs	Connected graph	Eulerian and Hamiltonian graphs	Planar and plane graphs
	SLO-2	Application of Graph Theory in other fields	Need for matrix representation	Illustrating examples and counterexamples	Illustrating examples and counterexamples	Illustrating examples, application
S-2	SLO-1	Preliminary definition of graph and its types	Adjacency matrix	Connected components of a graph	Graph with minimum degree atleast 2 is always cyclic	K_5 is non-planar
	SLO-2	Illustration with examples	Examples, properties	Bounds on degree of graph to be connected	Consequence of the above result	Proof by illustration
S-3	SLO-1	Minimum and maximum degree of a graph, regular graph	Incidence matrix	Characterization result for connected graphs with respect to vertex partition	Equivalent conditions for a connected graph to be eulerian	Faces of a plane graph
	SLO-2	Handshaking lemma – proof and consequences	Examples, properties	Characterization result for connected graphs with respect to vertex partition	Proof and consequences	Stereographic projection – proof and consequences
S-4	SLO-1	Subgraph – different types	Binary operations on graphs – union, sum	Result on connectedness of a graph and its complement	Illustration of Konigsberg Bridge Problem	Fary's theorem – statement only
	SLO-2	Illustrating examples	Illustration	Nordhaus-Gaddum type results on connectedness	Results based on existence of open trails in a graph	Polyhedral graph - properties
S-5	SLO-1	The size of a triangle-free graph of order p is atmost $[p^2/4]$.	Binary operations on graphs – product, composition	Characterization result for bipartite graphs	Arbitrarily traversable graph	Euler's polyhedron formula
	SLO-2	Proof and consequences	Illustration	Characterization result for bipartite graphs	Fleury's algorithm	Illustration of Euler's polyhedron formula
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Isomorphism	Result on order and size of graph operations	Cutpoint, bridge	Every Hamiltonian graph is 2-connected	Consequences of Euler's polyhedron formula
	SLO-2	Examples and counterexamples	Illustrating proof and consequences	Illustrating examples	Necessary condition for a graph to be Hamiltonian	Maximal planar graph, Triangulated graph

S-8	SLO-1	Properties of isomorphism and some basic results	Degree sequence, graphic sequence	Equivalent statements for a vertex to be cutpoint of a graph	Converse of the above result is not true	Homeomorphic graphs
	SLO-2	Proof	Examples	Results based on the above theorem	Dirac's theorem	Properties; Kuratowski's theorem;
S-9	SLO-1	Automorphism group of a graph	Problems on graphic sequence	Equivalent statements for a line to be bridge of a graph	Closure of a graph	Contractible graph, dual of a planar graph
	SLO-2	Illustration	Solution to problems	Consequences	Closure is a well defined property	Illustration and properties
S-10	SLO-1	Self complementary graph-definition, example and counterexample	Characterization of a graphic sequence	Characterization for a line to be a bridge in a graph	G is Hamiltonian ifff its closure is Hamiltonian	Chromatic number, n-colourable graph
	SLO-2	Results on self-complementary graphs	Suffiencient condition is not necessary	Existence of non-cutpoints in a graph	Chavatal's theorem	Determination of chromatic number for some known graph families
S-11	SLO-1	Covering number, independence number	Algorithm to determine a graphic sequence	Block – definition	Petersen graph is nonhamiltonian	Equivalent conditions for a graph to be 2-colourable
	SLO-2	Illustrating Examples	Explanation with example	Examples and counterexamples	Petersen graph is nonhamiltonian	Illustration of the above conditions
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Result on sum of independence and covering numbers	Necessary condition for a partition to be graphic	Equivalent conditions for a graph to be a block	Trees	k-critical graph; bounds on minimum degree of a k-critical graph
	SLO-2	Result on sum of independence and covering numbers	Proof and consequences	Illustration of the above conditions	Construction of all trees with the same order	Consequences of the above result
S-14	SLO-1	$\alpha' + \beta' = p$	Walk, trail, path, cycle	Connectivity and line-connectivity of graphs	Equivalent conditions for a graph to be a tree	$\chi \leq \Delta+1$
	SLO-2	Proof and consequences	Examples	Determination of connectivity and line-connectivity for some known graph families	Proof and consequences	Bounds on chromatic number of graph with respect to minimum degree of its induced subgraphs
S-15	SLO-1	Intersection graph	Any walk will contain a path	$k \leq \lambda \leq \delta$	Every connected graph has a spanning tree	Uniquely colourable graph
	SLO-2	Every graph is an intersection graph	Converse is not true in general	Proof by case studies	Adding an edge of graph which is not in its spanning tree T yields a unique cycle in it	Conditions for a graph to be uniquely colourable
S-16	SLO-1	Line graph	Graph will always contain a path of length equal to its minimum degree	n-connected and n-line connected graphs	Centre of a tree, Eccentricity, radius, diameter	Every uniquely n-colourable graph is (n-1)-connected
	SLO-2	Basic results	Proof	Illustrating examples	Examples	Edge colouring, edge chromatic number
S-17	SLO-1	Theorems of Whitney and Beineke	An odd length closed walk will always contain an odd cycle	Bound on size of a k-connected graph	Existence of centre in any tree	Vizing's theorem – statement only
	SLO-2	Consequences	An odd length closed walk will always contain an odd cycle	Nonexistence of a 3-connected graph with size 7	Illustrating examples with one and two centres	Edge chromatic number for complete graphs
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. S. Arumugam, S. Ramachandran, Invitation to Graph Theory, Scitech Publications (India) Pvt Ltd., 2006. 2. Jonathan L. Gross, Jay Yellen, Mark Anderson, Graph Theory and Its Applications, 3e, Chapman and Hall (CRC Press), 2018. 3. Gary Chartrand, Introductory Graph Theory, Dover Publications Inc. New York, 1977. 4. Robin J. Wilson, Introduction to Graph Theory, Fourth Edition, Pearson, 2009.	7. Arthur Benjamin, Gary Chartrand, Ping Zhang, The Fascinating World of Graph Theory, Princeton University Press, 2015. 8. S. A. Choudham, A First Course in Graph Theory, Macmillan India Ltd, 2000. 9. J. A. Bondy and U. S. R. Murthy, Graph Theory with Applications, Macmillon, 2008.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										

Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs. T. Karthy, SRMIST Dr. A. Anuradha, SRMIST

Course Code	UMA20D08T	Course Name	SEQUENCES AND SERIES	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	To learn about Convergence of sequences	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	To gain knowledge about convergence of series																		
CLR-3 :	To know about tests of convergence of infinite real series																		
CLR-4 :	To study about Alternative series																		
CLR-5 :	To learn about Binomial Theorem, Exponential and Logarithmic series																		
CLR-6 :	To know about Summation of series, Successive difference and recurring series																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Solve problems on convergence of sequences	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Solve problems on convergence of series	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Solve problems on convergence of alternative series	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Gain knowledge about Binomial Theorem, Exponential and Logarithmic series	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To know about Summation of series	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	To know about Summation of series, Successive difference and recurring series	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Introduction to sequences	Introduction to infinite series	Introduction to Cauchy's condensation test	Introduction to Binomial theorem	Summation of series
	SLO-2	Limits of sequences	Convergence of infinite series	Cauchy's condensation test	Binomial theorem for rational index	
S-2	SLO-1	Convergence of sequences	divergence of infinite series	Problems using Cauchy's condensation test	Problems on Binomial theorem	Applications of partial fractions
	SLO-2	Basic theorems in convergence of sequences	divergence of infinite series	Problems using Cauchy's condensation test	Problems on Binomial theorem	Problems on Applications of partial fractions
S-3	SLO-1	Cauchy's principle of convergence	Oscillation of infinite series	Problems using Cauchy's condensation test	Introduction to middle term of series	Problems on Applications of partial fractions
	SLO-2	Cauchy 's sequence	Oscillation of infinite series	Problems using Cauchy's condensation test	Problems of finding middle term	Problems on Applications of partial fractions
S-4	SLO-1	Cauchy 's first theorem on limits	Necessary condition for Convergence of infinite series	Problems using Cauchy's condensation test	Problems of finding the nth term	Problems on Applications of partial fractions
	SLO-2	Bounded sequences	Problems using Necessary condition for Convergence series	Problems using Cauchy's condensation test	Problems of finding the nth term	Problems on Applications of partial fractions
S-5	SLO-1	Monotonic sequences	Convergence of Geometric series	Problems using Cauchy's condensation test	Introduction to Exponential series	Sum to the n terms of the series
	SLO-2	Basic theorems on monotonic sequences	Convergence of Geometric series	Problems using Cauchy's condensation test	Exponential series	Problems on Sum to the n terms of the series
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

S-7	SLO-1	Limit superior	Introduction to Comparison test	Introduction to Cauchy's root test	Problems on Exponential series	Problems on sum to the n terms of the series
	SLO-2	Limit inferior	Comparison test	Cauchy's root test	Problems on Exponential series	Problems on Sum to the n terms of the series
S-8	SLO-1	Problems on limit inferior and limit superior	Problems using Comparison test	Problems using Cauchy's root test	Introduction to Logarithmic series	Problems on sum to the n terms of the series
	SLO-2	Problems on limit inferior and limit superior	Problems using Comparison test	Problems using Cauchy's root test	Logarithmic series	Problems on sum to the n terms of the series
S-9	SLO-1	Problems on Bounded sequences	Introduction to D'Alembert's ratio test	Problems using Cauchy's root test	Problems on Logarithmic series	Introduction to Summation by difference series
	SLO-2	Problems on Bounded sequences	D'Alembert's ratio test	Problems using Cauchy's root test	Problems on Logarithmic series	Summation by difference series
S-10	SLO-1	Problems on monotonic increasing sequences	Problems using D'Alembert's ratio test	Problems using Cauchy's root test	Introduction to summation of series	Introduction to Successive differences series
	SLO-2	Problems on monotonic decreasing sequences	Problems using D'Alembert's ratio test	Problems using Cauchy's root test	summation of series	Problems on Summation by difference series
S-11	SLO-1	Problems on Cauchy's sequences	Problems using D'Alembert's ratio test	Problems using Cauchy's root test	Applications of the Binomial theorem to the summation of series	Problems on Summation by difference series
	SLO-2	Problems on Cauchy's sequences	Problems using D'Alembert's ratio test	Problems using Cauchy's root test	Applications of the Binomial theorem to the summation of	Problems on Summation by difference series
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Problems on convergence of sequences	Introduction to Rabbe's test	Introduction to Alternative series	Problems of Finding the sum to infinity of the series	Introduction to Recurring series
	SLO-2	Problems on convergence of sequences	Rabbe's test	Examples of Alternative series	Problems of Finding the sum to infinity of the series	Generating function of Recurring series
S-14	SLO-1	Problems on convergence of sequences	Problems using Rabbe's test	convergence of alternative series	Introduction to Sum of coefficients	Problems of finding the nth term of recurring series
	SLO-2	Problems on convergence of sequences	Problems using Rabbe's test	convergence theorems of alternative series	Problems on sum of coefficients	Problems of finding the nth term of recurring series
S-15	SLO-1	Problems on convergence of sequences	Problems using Rabbe's test	Problems on convergence of alternative series	Approximate values	Problems of finding the nth term of recurring series
	SLO-2	Problems on convergence of sequences	Problems using Rabbe's test	Problems on convergence of alternative series	Finding approximate values	Problems of finding the nth term of recurring series
S-16	SLO-1	Problems on convergence of sequences	Problems on all the above tests	Problems on convergence of alternative series	Modification of the logarithmic series	Problems of finding the nth term of recurring series
	SLO-2	Problems on convergence of sequences	Problems on all the above tests	Problems on convergence of alternative series	Problem on Modification of the logarithmic series s	Problems of finding the nth term of recurring series
S-17	SLO-1	Problems on convergence of sequences	Problems on all the above tests	Problems on convergence of alternative series	Problem on Modification of the logarithmic series s	Problems of finding the nth term of recurring series
	SLO-2	Problems on convergence of sequences	Problems on all the above tests	Problems on convergence of alternative series	Problem on Modification of the logarithmic series s	Problems of finding the nth term of recurring series
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. T.K Manicavachagam Pillai, T. Natarajan, K.S. Ganapathy, Algebra, Volume 1, S. Viswanathan Pvt Limited, Chennai, 2004 2. M.K. Singal & Asha Rani Singal, A first course in real analysis, R. Chand & Co., 1999	3. Dr. S Arumugam, Sequences and series, New Gamma Publishers, 1999.

Learning Assessment												
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**

Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs. D. Thanga Rajathi, SRMIST

Course Code	UMA20D09T	Course Name	Linear Algebra	Course Category	E	Discipline Specific Elective Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3
CLR-1:	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.			
CLR-2:	Relate matrices and linear transformations.			
CLR-3:	Compute eigen values and eigen vectors of linear transformations.			
CLR-4:	Learn properties of inner product spaces and determine orthogonality in inner product spaces			
CLR-5:	Realise importance of adjoint of a linear transformation and its canonical form			
CLR-6:	Learn triangular forms of a vector space			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1:	Know the fundamental concepts vector spaces, subspaces, bases and dimension.	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2:	Link matrices and linear transformations.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3:	Learn to compute eigen values and eigen vectors of linear transformations.	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4:	Explain the significance of inner product spaces and their properties.	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5:	Analyze adjoint of a linear transformation.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6:	Understand concepts of canonical and triangular forms of a vector space.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Vector space-Definition	Inner product space-Definition	Linear Transformation-Definition	Isomorphism of vector spaces	Linear operator-Definition and examples
	SLO-2	Vector space -Examples.	Inner product space-Examples	Linear Transformation-examples	Theorems based on Isomorphism	Adjoint of a Linear operator
S-2	SLO-1	Problems based on vector space	Inner product space-Applications	Properties of Linear Transformation	Dual space-Definition	Problems based on linear operator
	SLO-2	Elementary Properties of vector spaces.	Norm of a vector	Algebra of Linear transformation	Dual space-Examples	Unitary operators-Definitions and properties
S-3	SLO-1	Elementary theorems of vector spaces	Properties on Norm of a vector	Product of Linear transformation	Problems on Dual space	Theorems on Unitary operators
	SLO-2	Vector subspaces-Definition, examples	Schwarz inequality	Theorems on Product of Linear transformation	Dual basis-Definitions	Normal operators-Definitions and Illustrations
S-4	SLO-1	Problems based on vector subspace	Triangle inequality	Algebra of linear operator	Theorems based on dual basis	Theorems on Normal operators
	SLO-2	Problems based on vector subspace	Orthogonal vectors	Range space of linear transformation	Problems on dual basis	Hermitian forms-Definitions
S-5	SLO-1	Elementary Properties of vector subspaces	Theorems based on Orthogonal vectors	Theorems on range space	Second dual space-Definition	Hermitian forms-Examples
	SLO-2	Algebra of subspaces	Problems involving Orthogonal vectors	Null space of linear transformation	Second dual space-Examples	Theorems based on Hermitian forms
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Linear sum of two subspaces	Orthonormal vectors	Theorems on Null space	Theorems on second dual space	Problems inon Hermitian forms

	SLO-2	Direct sum of two subspaces	Theorems based on Orthonormal vectors	Sylverster theorem	Natural mapping	Jordan canonical form
S-8	SLO-1	Quotient space-Definition and example	Problems involving Orthonormal vectors	Invertible Linear transformation	Annihilator	Problems based on Jordon canonical form
	SLO-2	Elementary Properties of Quotient space	Orthogonal basis -Definition, examples	Theorems on Invertible Linear transformation	Theorems on Annihilator	Rational canonical form
S-9	SLO-1	Internal direct sum of vector spaces	Problems on Orthogonal basis	Problems on Invertible Linear transformation	Annihilator of an Annihilator	Trace of a matrix-Definition and examples
	SLO-2	External direct sum of vector spaces	Orthogonal complement of a subspace	Non -singular Linear transformation	Eigen values and Eigen vectors of a Linear transformation	Theorems based on trace
S-10	SLO-1	Linear combination of vectors	Gram-Schmidt process for constructing orthonormal basis	Theorems on non-singular linear transformation	Theorems based on Eigen values	Properties of Trace
	SLO-2	Linear dependence and Independence of vectors	Problems based on Gram-Schmidt process for constructing orthonormal basis	Matrix representation of a linear transformation	Theorems based on Eigen vectors	Problems on trace
S-11	SLO-1	Problems based on Linear dependence of vectors	Bessel's Inequality	Problems on Matrix representation	Problems on Eigen values	Determinant of a linear transformationon of a finite dimensional vector space
	SLO-2	Problems based on Linear independence of vectors	Orthogonal Expansion	Similarity of matrices	Problems on Eigen vectors	Problems on Determinant of a linear transformation
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Problems based on linear independence	The Adjoint of a Linear Transformation	Similarity of linear transformation	Monic polynomial	Transpose-Definition
	SLO-2	Basis of vector space	Properties of the Adjoint	Triangular forms	Cayley-Hamilton Theorem	Transpose- Examples
S-14	SLO-1	Problems on basis of vector space	Self-Adjoint Transformation-Definitions	Characteristics root-Problems	Problems based on Cayley-Hamilton Theorem	Properties of Transpose
	SLO-2	Dimension of a vector space	Properties of Self-Adjoint Transformation	Theorems based on Triangular forms	Minimal polynomial-Definition and examples	Theorems based on Transpose
S-15	SLO-1	Dimension of subspace of a vector space	Theorems on Self-Adjoint Transformation	Canonical forms	Problems based on minimal polynomial	Problems based on Transpose
	SLO-2	Elementary theorems based on the dimension of a vector space.	Problems on Self-Adjoint Transformation	Theorems based on Canonical forms	Theorems based on minimal polynomial	Rank and Nullity –Definitions
S-16	SLO-1	Linear Span-Definition and examples	Congruent Operators	Nilpotent Transformations-Definitions	Primary Decomposition theorem	Rank and Nullity -Examples
	SLO-2	Elementary Properties of Linear Span.	Theorems on Congruent Operators	Nilpotent Transformations-Examples	Diagonalization	Theorems based on Rank and Nullity
S-17	SLO-1	Homomorphism	Inner Product Vector Space Isomorphism	Basic properties	Geometric multiplicity	Invariant subspaces
	SLO-2	Problems	Orthogonal Projections	Lemmas	Algebraic multiplicity	Problems based on invariant subspaces
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources

1. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003). Linear Algebra (4thedition). Prentice-Hall of India Pvt. Ltd.
2. Kenneth Hoffman & Ray Kunze (2015). Linear Algebra (2nd edition). Prentice-Hall.
3. I. M. Gel'fand (1989). Lectures on Linear Algebra. Dover Publications.
4. Dr.Sudhir Kumar Pundir(2015).A competitive approach to Linear Algebra(1st Edition).CBS Publishers & Distributors Pvt. Ltd.
5. Nathan Jacobson (2009). Basic Algebra I & II (2nd edition). Dover Publications.
6. Serge Lang (2005). Introduction to Linear Algebra (2nd edition). Springer India.
7. Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd Edition). Narosa Publishing House.
8. Gilbert Strang (2014). Linear Algebra and its Applications (2nd edition). Elsevier.
9. I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiely, NewYork, 2013.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										

Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. R. Perumal, SRMIST Dr. R. Arulprakasam, SRMIST

Course Code	UES20AE1T	Course Name	ENVIRONMENTAL STUDIES	Course Category	A	Ability Enhancement Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Applications*		Data Book / Codes/Standards	*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	*To teach the importance of environment*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	*To impart the knowledge about ecosystem*																		
CLR-3 :	*To teach about Biodiversity*																		
CLR-4 :	*To create awareness about environmental pollution*																		
CLR-5 :	*To understand about Environment Protection*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To gain knowledge on the importance of natural resources and energy*	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To understand the structure and function of an ecosystem*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To imbibe an aesthetic value with respect to biodiversity, understand the threats and its conservation and appreciate the concept of interdependence*	2	70	65	H	-	-		-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To understand the causes of types of pollution and disaster management*	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*To observe and discover the surrounding environment through field work*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Environmental Studies- Concept*	*Concept of an ecosystem*	*Biodiversity at Global, National And Local Levels*	*Causes, Effects and Control Measures of Nuclear hazards*	*Need for equitable utilization*
	SLO-2	*Scope and Importance of Environmental Studies*	*Ecosystem degradation and Resource utilization*	*India as a Mega Diversity Nation*		*Equity – Disparity*
S-2	SLO-1	*Need for public awareness.*	*Structure and Functions of an ecosystem*	*Threats to biodiversity: habitat loss, poaching of wildlife*	*Solid Waste Management Causes, Effects and Control Measures of Urban and Industrial Waste*	*Urban – rural equity issues*
	SLO-2	*Institutions in Environment*	*Producers, consumers and decomposers*	*man-wildlife conflicts*		*The need for Gender Equity*
S-3	SLO-1	*People in Environment*	*Energy flow in the ecosystem*	*Endangered species of India*	*Role of Individuals In Pollution Prevention*	*Preserving resources for future generations*
	SLO-2	*Awareness about Environmental Studies*	*The water cycle , The Carbon cycle , The Oxygen cycle , The Nitrogen cycle , The energy cycle and, Integration of cycles in nature*	*Endemic species of India*		*The rights of animals*
S-4	SLO-1	*Introduction to natural resources- Associated Problems*	*Ecological succession*	*Environmental Pollution- Definition*	*Disaster management- Nature Floods, Earthquakes*	*The ethical basis of environment education and awareness*
	SLO-2	*Renewable and Nonrenewable resources*	*Food chains, Food webs and Ecological pyramids*			
S-5	SLO-1	*Forest resources*	*Ecosystem, Introduction, Types, Characteristic features, Structure and functions*	*Causes, Effects and Control Measures of Air Pollution*	*Cyclones Landslides*	*The conservation ethic and traditional value systems of India*
	SLO-2	*Water Resources*	*Forest ecosystem*			
S-6	SLO-1	*Mineral Resources*	*Grassland ecosystem*	*Causes, Effects and Control Measures of Water Pollution*	*Social Issues and the Environment From Unsustainable to Sustainable Development*	*Wasteland Reclamation*
	SLO-2	*Food Resources*	*Desert ecosystem*			
S-7	SLO-1	*Energy Resources*	*Aquatic ecosystems (ponds, lakes, streams)*		*Water Conservation*	*Climate change & Global warming*

	SLO-2	*Land Resources*	*Aquatic ecosystems (rivers, estuaries, oceans)*	*Causes, Effects and Control Measures of Soil Pollution*		
S-8	**SLO-1**	*Renewable and non-renewable resources- Wind*	*Value Of Biodiversity*	*Causes, Effects and Control Measures of Marine pollution*	*Rain Water Harvesting Watershed*	*Acid rain & Ozone layer depletion*
	SLO-2	*Renewable and non-renewable resources-geothermal*	*Consumptive Value And Productive Value*			
S-9	**SLO-1**	*Renewable and non-renewable resources- Solar*	*Social Value and Ethical Value*	*Causes, Effects and Control Measures of Noise Pollution*	*Environmental Ethics: Issues and Possible Solutions*	*Nuclear Accidents and Nuclear Holocaust*
	SLO-2	*Renewable and non-renewable resources-Biomass*	*Aesthetic Value and Option Value*	*Causes, Effects and Control Measures of Thermal Pollution*	*Resource consumption patterns*	

Learning Resources	**Theory:** 1. Bharucha Erach, (2013), Textbook of Environmental Studies for Undergraduate Courses (Second edition). Telangana, India: Orient BlackSwan. 2. Basu Mahua, Savarimuthu Xavier, (2017), SJ Fundamentals of Environmental Studies. Cambridge, United Kingdom: Cambridge University Press 3. Dr.R.Jeyalakshmi.2014.,Text book of Environmental Studies, Devi publications, Chennai 4. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India, Email:mapin@icenet.net (R)

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40	-	40	-	40	-	40	-	40	-
	Understand										
Level 2	Apply	30	-	30	-	30	-	30	-	30	-
	Analyze										
Level 3	Evaluate	30	-	30	-	30	-	30	-	30	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers

Experts from Industry	Experts from Academic	Internal Experts
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		2.Dr.S.Albert Antony Raj, Associate Professor and Head, SRMIST

Course Code	UJK20501T	Course Name	Leadership and Management Skills	Course Category	JeevanKaushal-JK	Life Skill Courses	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	*Parent Department	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	help students to develop essential skills to influence and motivate others	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLR-2:	Inculcate emotional and social intelligence and integrative thinking for effective leadership																		
CLR-3:	create and maintain an effective and motivated team to work for the society																		
CLR-4:	nurture a creative and entrepreneurial mindset																		
CLR-5:	make students understand the personal values and apply ethical principles in professional and social contexts																		
CLR-6:	manage competency-mix at all levels for achieving excellence with ethics																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	examine various leadership models and understand / assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision	3	80	75	L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-2:	learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, team leadership, etc	3	80	75	L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-3:	understand the basics of entrepreneurship and develop business plan	3	75	70	L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-4:	apply the design thinking approach for leadership	3	75	70	L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-5:	appreciate the importance of ethics and moral values for making of a balanced personality	3	75	70	L	H	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-6:	be an integral human being	3	75	70	L	H	H	-	M	M	-	-	-	M	H	L	-	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Leadership - definition	Team building	Management – definition	Women in management	Entrepreneurship
	SLO-2	Leadership – qualities	Team dynamics	Manager – traits	Global gender perspective in business. Do women make good managers? - discussion	Entrepreneurship
S-2	SLO-1	Leadership – styles	Work delegation	Scheduling work	Confronting problems faced by women managers – case study	Successful Indian entrepreneurs – case study
	SLO-2	Leadership – styles	Work delegation – activity	Scheduling work – activity	Confronting problems faced by women managers – case study	Successful Indian entrepreneurs – case study
S-3	SLO-1	Difference between leader and boss	Decision making	Strategic planning	Successful women managers – documentary screening	Successful women entrepreneurs – case study
	SLO-2	Case study (based on leadership styles)	Decision making - activity	Strategic planning	Successful women managers – documentary screening	Successful women entrepreneurs – case study
S-4	SLO-1	Case study (based on leadership styles)	Motivation	Change management	Women labour force in work place	Ethics – definition
	SLO-2	Case study (based on leadership styles)	Motivating for results	Change management – activity	Problems faced by women labour force in work place - case study	Corporate ethics
S-5	SLO-1	Leadership in diverse organizational structures, cultures and communications	Argumentation, Persuasion	Energy management	Sexual harassment of women at workplace (prevention, prohibition, and redressal) Act, 2013	Essential elements of business ethics
	SLO-2	Leadership in diverse organizational structures, cultures and communications	Negotiation , Networking	Novel ways to manage energy in work place – activity	Documentary screening - Sexual harassment of women at workplace	Activity (students formulate ethical code of their business organization)

S-6	SLO-1	Leading the organisation through stability and turbulence	Budget planning	Work force management	Transgender persons protection of rights act, 2019	Ethical dilemma
	SLO-2	Case study	Taking risk	Grievance redressal policy in organisations	Documentary screening – based on inclusiveness of the third gender in workplace	Ethical dilemma - case study

Learning Resources	1. Craig E Johnson, Meeting the ethical challenges of leadership, Sage publications, 2018 2. Allan R Cohen, David L Bradford, Influence without authority, Wiley, 2018 3. T V Rao, Managers who make a difference: Sharpening your management skill, Random house India, 2016	4. Alexander Osterwalder, Business Model Generation,Wiley, 2013 5. Deborah Tannen, Talking from nine to five: Women and men in the workplace, Harper Collins publishers, 2010 6. Amish Tandon, Law of sexual harassment at workplace: Practice and procedure,Niyogi books, 2017 7. Rashmi Bansal, Connect the dots, Westland books, 2012

Learning Assessment					
Level	**Bloom's Level of Thinking**	**Continuous Learning Assessment (100% weightage)**			
		CLA-1 (20%)	**CLA-2 (20%)**	**CLA-3 (30%) #**	**CLA-4 (30%) ##**
		Theory	**Theory**	**Theory**	**Theory**
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.
CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	1. Ms Sindhu Thomas B, AssistantProfessor& Head in Charge, CDC, FSH, SRMIST 2. Mr Rajsekar, Assistant Professor, CDC, FOM, SRMIST

Course Code	UMA20601T	Course Name	COMPLEX ANALYSIS	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand the concepts of analytic function.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To learn the concepts of transformation in complex variable.																		
CLR-3:	To know how to integrate the complex function																		
CLR-4:	To learn the concepts of different types of singularities																		
CLR-5:	To learn the calculation of residues																		
CLR-6:	To understand the evaluation of integrals of different types																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Explain the analytic function and its properties	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Explain the transformation concepts in complex variable.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Explain several facts on complex integration	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Relate the singularities of different types and determine the power series expansion of Taylor's and Laurent's series.	3	85	80	H	H		M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Evaluate the different types of real definite integrals.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Explain the fundamental concepts in complex analysis such as analyticity, transformation, singularities and contour integration.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module-II (18)	Module-III (18)	Module-IV (18)	Module-V (18)
S-1	SLO-1	Complex function-Definition, examples.	Mappings Introduction	Integration of complex function	Power series	Residues -Definition
	SLO-2	Extended complex plane	Conformal Mapping	Simple curve	Radius of convergence of the power series	Calculation of residues
S-2	SLO-1	Stereographic projection	Isogonal mapping	Contour integral	Taylors series	Calculation of residues--Examples
	SLO-2	Riemann Sphere	Magnification	Simple integral using definition	Taylors theorem --proof	Problems based on residue
S-3	SLO-1	Complex variable ,Limit of a function	Magnification and rotation	Definite integrals of function	Uniqueness theorem	Cauchy Residue theorem
	SLO-2	Continuity of a function	Inversion and reflection	Definite integrals--problems.	Taylor's theorem-Examples	Cauchy Residue theorem with proof
S-4	SLO-1	Theorems based on continuity	w=az+b transformation	. Definite integrals--problems	Taylor's theorem-Examples.	Cauchy Residue theorem with proof
	SLO-2	Uniform continuity	,w=1/z transformation	Simply connected region	Zeros of an analytic function.	Problems based on Cauchy Residue theorem
S-5	SLO-1	Differentiability of a function	Problems based on transformation	Cauchy fundamental theorem	Laurent's theorem with proof	Practice Problems
	SLO-2	Theorems based on differentiability	$w=z^2$ transformation	Integral along an arc joining two points	Laurent's theorem with proof	Problems based on Cauchy Residue theorem
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	.Analyticity of a function	$w=\sqrt{z}$ transformation	Practice Problems	Laurent Series	Real definite integral
	SLO-2	Necessary condition for differentiability	Problems based on transformation	Cauchy goursat theorem--statement	Problems based on Laurent theorem	Real definite integral
S-8	SLO-1	Sufficient condition for differentiability	$W= e^z$ transformation	Cauchy integral theorem	Problems based on Laurent theorem	Evaluation of Integral of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta.$

	SLO-2	C--R equations in polar form	Problems based on transformation	Problems based on theorem	Problems based on Laurent theorem	Evaluation of Integral of the type $\int_0^{2\pi} f(\cos\theta,\sin\theta)d\theta.$
S-9	SLO-1	Practice Problems	Theorems based on transformation	Practice Problems	Singularity-Definition	Practice Problems
	SLO-2	Harmonic function Definition, examples.-.	Bilinear transformation	integral theorem for first derivatives	Singularity-Examples	Jordan's lemma --Statement
S-10	SLO-1	Analytic function--Properties	Cross ratio and its invariance property	Integral formula for nth derivative	Isolated Singularity-Definition	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\sin axdx, a>0$
	SLO-2	Analytic function--Properties	Theorems based on Bilinear transformation	Problems based on theorem	Isolated Singularity--Examples	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\sin axdx, a>0$
S-11	SLO-1	Problems based on properties	Theorems based on Bilinear transformation	Problems based on theorem	Removable Singularity-Definition	Practice Problems
	SLO-2	Harmonic conjugate	Theorems based on Bilinear transformation	Problems based on theorem	Removable Singularity - Example	Problems based on properties
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Determination of harmonic conjugate examples	Problems based on Bilinear transformation	Related integral theorem.	Essentialsingularity-Definition	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\cos axdx, a>0$
	SLO-2	Determination of harmonic conjugate examples	Problems based on Bilinear transformation	Related integral theorem—Morera's theorem	Essential singularity-Examples	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\cos axdx, a>0$
S-14	SLO-1	Construction of an Analytic function	Special Bilinear transformation	Related integral theorem—Liouville's theorem	pole-Definition	Practice Problems
	SLO-2	Construction of an Analytic function when real part is known	Practice Problems	Related integral theorem—Cauchy Inequality	Pole-examples	Problems on the above
S-15	SLO-1	Problem on the above	Problem on the above	Problem on the above	Problem on the above	Evaluation of Integral of the type $\int_{-\infty}^{\infty} \frac{p(x)}{q(x)}dx$
	SLO-2	More problems	More problems	More problems	More problems	More problems
S-16	SLO-1	Construction of an Analytic function when real part is known.	Theorems based on special bilinear transformation.	Related integral theorem-Fundamental theorem of Algebra	Nature of singularities	Evaluation of Integral of the type $\int_{-\infty}^{\infty} \frac{p(x)}{q(x)}dx$
	SLO-2	Construction of an Analytic function when imaginary part is known	Theorems based on special bilinear transformation	Poisson integral formula	Determination of Nature of singularities	Practice problems
S-17	SLO-1	Construction of an Analytic function when imaginary part is known	Theorems based on special bilinear transformation	Maximum modulus principle	.Nature of singularities--problems	Evaluation of Integrals of the form $\int_{-\infty}^{\infty} f(x)dx$
	SLO-2	Construction of an Analytic function when imaginary part is known	Theorems based on special bilinear transformation	Maximum modulus principle with proof	Nature of singularities-problems	Evaluation of Integrals of the form $\int_{-\infty}^{\infty} f(x)dx$
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. S.Narayanan and T.K.Manicavachagompillai, Complex Analysis, Revised Edition.S.Viswanathan Printers & Publishers,2002 2. P.Duripandian and LaxmiDuraipandian, Complex Analysis,EmeraldPublishers,Chennai, 2006. 3. S.Ponnusamy,Foundations of Complex Analysis,Narosa Publishing House,New Delhi,2nd edition,2013. 4. Murray R.Spiegel, Theory and problems of complex variable,Tata McGraw Hill Edition,New Delhi 2005	5. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed.,McGraw – Hill International Edition, 2009. 6. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts inMathematics, Springer-Verlag New York, Inc., New York, 3rd edition 2010. 7. J.N. Sharma, Functions of a Complex variable, Krishna Prakasan Media(P) Ltd, 13th Edition, 1996-97. 8. B.S.Thagi, Functions of a Complex variable,Kedarnath Ramnath,Meerut,2015..

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mrs. V. Vidya, SRMIST

Course Code	UMA20602T	Course Name	Mechanics	Course Category	C	Professional Core Course	L	T	P	C
							5	1	0	6

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand the concept of statics and dynamics which will be able to study simple harmonic motion and its properties	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To relate the concepts of impulse and familiar with the characteristic of elasticity																		
CLR-3:	To learn concepts related to spheres and properties																		
CLR-4:	To understand concepts of motion and study in detail motion of a projectile and trajectories																		
CLR-5:	To learn the concepts of central forces and orbit																		
CLR-6:	To relate the concepts of the motion of a rigid body																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Acknowledge the existence of the mathematical representation of physical objects called simple harmonic motion	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2:	Prior knowledge about the fundamentals of simple harmonic motion	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3:	Develop a broad coverage of the topics on impulse, impulsive forces , spheres and elasticity	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4:	Examine the significance of motion of a projectile and trajectories	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5:	Acquire skill and sketches on central orbit and its properties	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6:	Know the fundamental concepts in two dimensional rigid body such as compound pendulum, period of oscillations, centre of oscillations and axis of a rigid body.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		Module-I (18)	Module- II (18)	Module-III (18)	Module- IV (18)	Module-V (18)
S-1	SLO-1	Statics-ODE-Problems, examples.	Impact- Definition, Examples	Projectiles- Definition, Examples	Central Orbits- General Orbits- Definition, Examples	Two dimensional motion of a rigid body- Definition, Examples
	SLO-2	Statics-PDE- Problems, ,examples	Impulsive force- Impulse- Definition, Examples	Forces on a projectile- Horizontal range, Maximum height, time of flight,Range on an incline plane- Definition, Examples	Central force, conic, Equiangular spiral- Definition, Examples	Kinetic energy, Angular momentum , Moment of effective forces- Definition, examples
S-2	SLO-1	Dynamics-Rigid bodies- Definition, examples	Conservation of linear momentum	Displacement as a combination of vertical and horizontal displacements- Definition, examples	Centre of force, polar coordinates- Definition, examples	Motion of a rigid body rotating about a fixed axis- Kinetic energy, angular momentum
	SLO-2	Dynamics- Parallel axis, Hooke's law, examples	Kinetic energy generated impulsively	Nature of a trajectory- Definition, Examples	Apse, maximum and minimum angular velocity- Definition, Examples	Motion of a rigid body rotating about a fixed axis- Moment , angular velocity
S-3	SLO-1	Velocity- Velocity of a particle describing a circle , resultant velocity- Definition, Problems	Impact – More problems	Nature of a trajectory- Derive the path of a projectile is a parabola	Areal velocity, moment of momentum – Definition, examples	Motion of a rigid body rotating about a fixed axis- Practice problems
	SLO-2	Acceleration –Rectilinear motion, Rectilinear motion with a constant acceleration- Definition, Problems	Impact of spheres- Definition- examples	Height of the directrix, Distance of focus from the point of projection- Definition, examples	Coplanar motion- Definition, examples	Motion of a rigid body rotating about a fixed axis- Practice problems
S-4	SLO-1	Newton's law of motion, Resultant of two forces on a particle- Definitions, Problems	Laws of impact- Law 1. Collision of two smooth spheres-	Nature of a trajectory- Derive the speed of a projectile at any point equals the speed falling from directrix	Velocity and acceleration in a coplanar motion- finding the components in two fixed perpendicular directions	Motion of a rigid body rotating about a fixed axis- more problems
	SLO-2	Forces on a rigid body- Moment of a force- Definition, Examples	Laws of Impact – Law 2 – Newton's Experimental law, ideal cases	Motion of a projectile, Results pertaining to the motion of projectile- Definition, results	velocity and acceleration of a particle- radial and transverse directions	Motion of a rigid body rotating about a fixed axis- Practice more problems

S-5	SLO-1	Equations of motion of a rigid body- Problems	Impact of two smooth spheres – Definition, Examples	Motion of a projectile, Results pertaining to the motion of projectile- Definition, results	Central orbits- more problems	Compound pendulum, centre of suspension, Definition, examples
	SLO-2	Kinetic energy of a rigid body- Definitions, Examples	Direct and oblique impacts- Definition, Examples	Kinetic energy, potential energy- Definitions and in case of projective sum be a constant	Central orbits- more problems	Period, simple equivalent pendulum, centre of oscillation- Definition, examples
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Coplanar motion-Angular velocity- Definition, Examples	Direct impact of two smooth spheres- Definition, Examples	Maximum horizontal range for a given velocity- Definition, examples	Central orbit-practice problems	To find the Period of small oscillations of a compound pendulum
	SLO-2	Coplanar motion- velocity and acceleration in a coplanar motion- Definition, Examples	Direct impact of two smooth spheres – Derive the velocities of two smooth spheres between them	Two trajectories with a given speed and range- Introduction	Central orbit- practice problems	Period of small oscillations- Problems
S-8	SLO-1	Simple Harmonic motion- Amplitude, Period, Phase- Definition, examples	Two smooth spheres collide directly- Derive its Impulse imparted to each sphere	Nature of a trajectory - more problems	Central orbit- motion of a particle subject to the action of a central force	Period is unaltered when the centre of suspension and oscillation are interchanged
	SLO-2	Simple Harmonic motion- Finding velocity and acceleration	Two smooth spheres collide directly- find the change in the total kinetic energy of the spheres	Nature of a trajectory - more problems	Central orbit- finding a central orbit is a plane curve	Finding minimum period of the compound pendulum
S-9	SLO-1	Projection of a particle having a uniform circular motion - Problems	Direct impact of two smooth spheres- More problems	Nature of a trajectory - more problems	Differential equation of a central orbit in polar coordinates-the motion is a coplanar	Compound pendulum- More problems
	SLO-2	Composition of two simple harmonic motions of same period- Problems	Direct impact of two smooth spheres- More problems	Nature of a trajectory - more problems	Differential equation of a central orbit in polar coordinates- coplanar motion	Compound pendulum -Practice Problems
S-10	SLO-1	Simple Harmonic motion along a horizontal line- Derive the motion of a light spiral spring pulled through a distance	Impact of a smooth sphere on a fixed plane- Introduction, Definition, examples	Projectile projected horizontally- Introduction	Differential equation for an attractive central force- Derivation	Compound pendulum- More problems
	SLO-2	Simple Harmonic Motion along a horizontal line – Examples, Problems	Impact of a smooth sphere on a fixed plane- Problems	Projectile projected on an inclined plane- time of flight, range on the plane	Differential equation for an attractive central force – constancy of moment of momentum	Compound pendulum -Practice Problems
S-11	SLO-1	Simple Harmonic Motion along a vertical line- Derive the motion of light elastic strings and earths gravitation	Direct impact of a smooth sphere on a plane- Definition, Examples	Maximum range on an inclined plane- finding angle between the inclined plane and the vertical line	Differential equation of a central orbit in p-r coordinates- Derivation	Reaction of the axis on a rigid body revolving around it
	SLO-2	Simple Harmonic Motion along a vertical line- Examples, Problems	Oblique impact of a smooth sphere on a plane- Definition, Examples	Maximum range down an inclined plane formula	Differential equation of a central orbit in p-r coordinates- finding equation for an attractive central force	Resultant reaction of the axis on the rigid body
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Motion under gravity in a resisting medium- Definitions, examples	Direct impact of a smooth sphere on a plane-Derive its Velocity of rebound, impulse imparted to the sphere	Projectile projected on an inclined plane- more problems	Law of central force- Introduction, Inverse Square law	Reaction of the axis on a rigid body revolving around it- Problems
	SLO-2	Resistance proportional to a square of velocity- Derive its motion of a particle	Direct impact of a smooth sphere on a plane-Derive its loss in Kinetic energy-	Projectile projected on an inclined plane- more problems	Method to find the central orbit	Reaction of the axis on a rigid body revolving around it- Problems
S-14	SLO-1	Resistance proportional to a square of the speed- Derive its motion of a particle	Direct impact of a smooth sphere on a plane- More problems	Enveloping parabola or bounding parabola - Introduction	Central orbit of a particle under an attractive central force inversely as the square of the distance	Equation of motion for a two dimensional motion
	SLO-2	Motion under gravity in a resisting medium- Problems	Direct impact of a smooth sphere on a plane- More problems	Finding the envelope of a family of trajectories from a fixed point and constant velocity	Central orbit of a particle under an attractive force- find its nature of the orbit and critical velocity	Angular acceleration, point of contact, centre of mass- Definition, examples
S-15	SLO-1	Motion under gravity in a resisting medium- Problems	Oblique impact of a smooth sphere on a plane- Derive its Velocity	Trajectories touch the enveloping parabola- Remarks, examples	Central orbit and its nature in p-r coordinates	Motion of a uniform circular disc rolling down an inclined plane

			of rebound, impulse imparted to it , loss in kinetic energy			
	SLO-2	Motion under gravity in a resisting medium- Problems	Oblique impact of a smooth sphere on a plane- more problems	Motion of a projectile- more problems	Central orbit of a particle under an attractive force varying as the distance	Motion of a uniform circular disc rolling down an inclined plane- Acceleration, distance travelled in time
S-16	SLO-1	Resistance proportional to velocity- Definitions, Examples	Oblique impact of a smooth sphere on a plane- more problems	Motion of a projectile- more problems	Central orbit under an attractive force- more problems	Motion of a uniform circular disc rolling down an inclined plane- Other rolling bodies
	SLO-2	Resistance proportional to velocity- Derive its motion fall rest, resistance varies as the speed.	Oblique impact of two smooth spheres- find the velocities of the spheres after impact	Moment of inertia- simple bodies- Definitions, Examples	Conic as a central orbit- Introduction, examples, problems	Motion of a uniform circular disc rolling down an inclined plane- Condition for rolling without sliding
S-17	SLO-1	Resistance proportional to velocity- Derive its motion projected vertically upwards, whose resistance varies as the speed.	Oblique impact of two smooth spheres- find the impulse imparted of the spheres and change in kinetic energy due to impact	Moment of inertia - Perpendicular axis theorem- Statement only	Central orbit is a conic – find its law of force	Motion of a uniform circular disc rolling down an inclined plane- Problems
	SLO-2	Resistance proportional to velocity- more Problems	Oblique impact of two smooth spheres- problems	Moment of inertia- Parallel axis theorem- statement only	Central orbit is a conic – find its speed of a particle	Motion of a uniform circular disc rolling down an inclined plane- Problems
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. M.K. Venkataraman, Statics, A. Rajhans Publications, 16th Edition, Meerut, 1990. 2. A.V Dharmapadam, Mechanics, S. Viswanathan Printers and Publishers, Chennai, 1991.	3. Naik, K.V and Kasi, M.S, Statics and Dynamics, Emerald Publishers, 1992. 4. P. Duraipandian and others , S. Chand and company Pvt. Ltd., New Delhi, 1979.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	30%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-
Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. V. Srinivasan, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. G. Sheeja, SRMIST

Course Code	UMA20D10L	Course Name	Project Work	Course Category	D	Discipline Specific Elective	L	T	P	C
							0	0	12	6

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

Assessment Method

	Continuous Learning Assessment (50% weightage)		Final Evaluation (50% weightage)	
Project Work	Review – 1	Review – 2	Project Report	Viva-Voce
	20%	30 %	30 %	20 %

Course Code	UMA20A01T	Course Name	Allied Mathematics-I	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	MATHEMATICS	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	Understand the concept of sets, relations and functions	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	Gain knowledge on the basics of logic																		
CLR-3:	Obtain the knowledge on polynomial equations																		
CLR-4:	gain knowledge on Matrices and its applications																		
CLR-5:	comprehend the working principle of various calculus techniques																		
CLR-6:	Understand various Mathematical evaluation procedure																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Acquire the knowledge on sets and functions	3	80	85	M	H	-	-	-	-	-	-	-	-	-	H	-	-	-
CLO-2:	Gain the ability to identify science and engineering problems logically	1	75	80	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Understand the basic ideas about polynomial equations	3	85	80	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Appreciate the concepts of Matrices in real life situations	3	80	75	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5:	Apply the knowledge of different calculus techniques	1	75	85	M	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	obtain the knowledge on Mathematical evaluation method	3	80	85	M	-	-	-	-	-	-	-	-	-	-	H	-	-	-

Duration (Hour)		Module 1 (9)	Module 2 (9)	Module 3 (9)	Module 4 (9)	Module 5 (9)
S-1	SLO-1	Sets - sets definition and representation of sets	Statements	Polynomial equations	Symmetric matrices,	Introduction to calculus
	SLO-2	Examples for sets and representations	Examples for statements	Examples for Polynomial equations	Skew symmetric matrices	Differential calculus - Introduction
S-2	SLO-1	Types of sets, operation on sets, Venn diagram	connectives, conjunction	Irrational roots	Hermitian, skew Hermitian matrices	Maxima and minima-Introduction
	SLO-2	Examples for types of sets and operations on sets	Examples for connectives, conjunction	Problems on irrational roots	Examples for different types of matrices	Simple problems on maxima and minima of functions of single variable
S-3	SLO-1	Relation - Types of Relation	Disjunction, negation	complex roots(up to third order equations only)	Orthogonal, Unitary matrices	More problems on maxima and minima
	SLO-2	Examples for types of relation	Examples for Disjunction, negation	Problems on equations with complex roots	Examples for Orthogonal, Unitary matrices	More problems on maxima and minima
S-4	SLO-1	Equivalence Relation	Tautology, Contradiction	Reciprocal equations	Cayley Hamilton Theorem	More problems on maxima and minima
	SLO-2	Examples and problems on equivalence relation	Problems on tautology, contradiction	Problems on reciprocal equation	Problems on Cayley Hamilton Theorem	Radius of curvature – Introduction
S-5	SLO-1	Function - Introduction	logical equivalence	Approximation of roots of a polynomial equation	Problems on Cayley Hamilton Theorem	Problems on Radius of curvature- Cartesian co – ordinate
	SLO-2	Types of functions	Examples for logical equivalence	Newton's Method-Introduction	Eigen values– Eigen vectors	Problems on Radius of curvature
S-6	SLO-1	Problems for different functions	tautological implications	Newton's method- Finding positive roots	Problems on Eigen values–Eigen vectors	More problèmes on radius of curvature
	SLO-2	Composite of two functions	Examples for tautological implications	More problems Newton's method- Finding positive roots	Problems on Eigen values–Eigen vectors	Partial differentiation
S-7	SLO-1	Examples for composite functions	arguments , Validity of arguments	Problems on Newton's method- Finding reciprocal of a given number	Problems on Eigen values–Eigen vectors	Problems on partial differentiation
	SLO-2	Composite of three functions	Normal forms	Problems on Newton's method- Finding Square root of a given number	Problems on Eigen values–Eigen vectors	More problems on partial diferentiation

S-8	SLO-1	Examples for composite of three functions	Principal disjunctive normal form	Horner's method- Introduction	Cramer's rule-Introduction	Euler's theorem- Introduction
	SLO-2	Problems on functions	Problems for pdnf	Horner's method Finding positive roots	Solving system of linear equations- Crammer's rule	Problems on Euler's theorem
S-9	SLO-1	Problems on composite of two functions	Principle conjunctive normal form	Problems on Horner's method- finding roots between given values	Problems on Crammer's rule	More Problems on Euler's theorem
	SLO-2	Problems on composite of three functions	Problems for pcnf	More Problems on Horner's method	More Problems on Crammer's rule	More Problems on Euler's theorem

Learning Resources	1. T. Veerarajan, Discrete Mathematics, 7th Edition, Tata-Mcgraw hill, New Delhi, 2006. 2. A. Singaravelu, ALLIED MATHEMATICS, 3rd Edition, Meenakshi Agency, Chennai, 2011.	3. P. R. Vittal, Allied Mathematics, 4th Edition Reprint, Margham Publications, Chennai, 2013. 4. S.G. Venkatachalapathy, Allied Mathematics, 1st Edition Reprint, Margham Publications, Chennai, 2007.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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

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Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. N. Balaji, SRMIST Dr. P. Sampath, SRMIST

Course Code	UMA20A02T	Course Name	Allied Mathematics II	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	UMA20A01T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	To understand the basics of integration.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2:	To learn the fundamental concept of Trigonometry.																		
CLR-3:	Understand to solve ordinary differential equations.																		
CLR-4:	To understand concepts of Laplace Transform and its properties.																		
CLR-5:	To learn the concepts of inverse Laplace Transform.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Students will able to apply the concepts of integral calculus, in finding area, surfaces, volume of the solid.	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2:	Students will able to be familiar with Trigonometry.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3:	Students will understand the concept of second order differential equations with constant coefficient and applying in mechanics and dynamics.	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4:	Students are able to understand the concept of Laplace transformation and applying in Science and Engineering	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5:	Students are able to understand the concept of Inverse Laplace transformation and applying in Science and Engineering.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Integral calculus-Basic integral formulae.	Expansion of $\sin n\theta, \cos n\theta$ in powers of $\sin\theta$ and $\cos\theta$, where n being a positive integer.	Introduction to second order differential equations with constant coefficients.	Introduction to Laplace Transforms	Introduction t Inverse Laplace Transforms
	SLO-2	Problems related to integral formulae.	Expansion of $\tan n\theta$.	Finding the order and degree of the differential equations.	Standard results of Laplace transforms	Standard results of Inverse Laplace transforms
S-2	SLO-1	Integrals of the type $\int \frac{dx}{ax^2+bx+c}$	Problems based on $\sin n\theta$	Solution of the differential equation – Complementary function and particular function.	Derivation of the standard results of Laplace transforms.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Problems based on $\sin n\theta$	Problems based on $(aD^2+bD+c)y=0$	Derivation of the standard results of Laplace transforms.	Simple problems based on results.
S-3	SLO-1	Integrals of the type $\int \frac{px+q}{ax^2+bx+c}dx$	Additional problems based on $\sin n\theta$	Additional problems on $(aD^2+bD+c)y=0$	Simple problems based on results.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Problems based on $\cos n\theta$	Problems based on $(aD^2+bD+c)y=e^{ax}$	Simple problems based on results.	Simple problems based on results.
S-4	SLO-1	Integrals of the type $\int \frac{dx}{\sqrt{ax^2+bx+c}}$	Problems based on $\cos n\theta$	Additional problems on $(aD^2+bD+c)y=e^{ax}$	Properties of Laplace Transforms.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Additional problems based on $\cos n\theta$	Problems based on $(aD^2+bD+c)y=\sin ax$	Properties of Laplace Transforms.	Inverse Laplace transforms of $sF(s)$
S-5	SLO-1	Integrals of the type $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$	Problems based on $\cos n\theta$ and $\tan n\theta$	Problems based on $(aD^2+bD+c)y=\sin ax$	Problems related to the properties of Laplace transforms.	Problems based on $L^{-1}[sF(s)]$
	SLO-2	Problems related to the above integral type.	Expansion of $\sin^n\theta$ and $\cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$ where n being a positive integer.	Additional problems based on $(aD^2+bD+c)y=\sin ax$	Problems related to the properties of Laplace transforms.	Additional problems on $L^{-1}[sF(s)]$

S-6	SLO-1	Integration by Partial fraction method (Simple algebraic functions only)	Problems based on $\sin^n\theta$ interms of $\sin\theta$.	Additional problems based on $(aD^2+bD+c)y=\sin ax$	Additional problems related to the first shifting property.	Inverse Laplace transforms of $\frac{F(s)}{s}$
	SLO-2	Problems related to the partial fraction method.	Problems based on $\sin^n\theta$ interms of $\cos\theta$.	Problems based on $(aD^2+bD+c)y=\cos ax$	Laplace transform of $tf(t)$	Problems based on $L^{-1}\left[\frac{F(s)}{s}\right]$
S-7	SLO-1	Additional problems related to the partial fraction method.	Problems based on $\sin^n\theta$ interms of $\cos\theta$.	Additional problems based on $(aD^2+bD+c)y=\cos ax$	Problems on Laplace transform of $tf(t)$	Additional problems based on $L^{-1}\left[\frac{F(s)}{s}\right]$
	SLO-2	Bernoulli's formula and related problems.	Problems based on $\cos^n\theta$ interms of $\cos\theta$.	Additional problems based on $(aD^2+bD+c)y=\cos ax$	Problems on Laplace transform of $\frac{f(t)}{t}$	Inverse Laplace transforms -partial fraction method
S-8	SLO-1	Reduction formula for $\int \sin^n x\,dx$	Problems based on $\cos^n\theta$ interms of $\cos\theta$.	Problems based on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $\frac{f(t)}{t}$	Partial fraction method-Related problems.
	SLO-2	Evaluation of $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$	Problems based on $\sin^n\theta$ $\cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.
S-9	SLO-1	Reduction formula for $\int \cos^n x\,dx$	Problems based on $\sin^n\theta$ $\cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.
	SLO-2	Evaluation of $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$	Problems based on $\sin^n\theta$ $\cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.

Learning Resources	1. Singaravelu. A, Allied Mathematics, 6th Revised Edition, Meenakshi Agency, 2014. 2. Vittal. P.R, Allied Mathematics, 4th Edition Reprint, Margham Publications, 2013. 3. Venkatachalapathy, S.G, Allied Mathematics, 1st Edition Reprint, Margham Publications, 2007. 4. T.K. Manickavasagam Pillai and S. Narayanan, Ancillary Mathematics, Reprint, S.Viswanathan Printers and Publishers Pvt. Ltd., Chennai. 5. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. Singapore, 10th edition, 2012. 6. T. Veerajan, "Engineering Mathematics I", Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006. 7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2012.

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Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

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