ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMME

Bachelor of Science in

Mathematics

Three Years /

Bachelor of Science (Honours) in Mathematics

Four Years

Learning Outcomes based Curriculum Framework (LOCF)

Choice Based Flexible Credit System

Academic Year

2023 – 2024

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

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

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

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.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*	*11.*	*12.*	*13.*	*14.*	*15.*
	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
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. Discipline Specific Core Courses (C) (20 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UMA23101T	Algebra and Geometry	3	1	0	2	4
UMA23102T	Calculus	3	1	0	2	4
UMA23103T	Ordinary Differential Equations	3	1	0	2	4
UMA23104T	Probability and Probability Distributions	3	1	0	2	4
UMA23105T	Multivariate Calculus	3	1	0	2	4
UMA23106T	Partial Differential Equations	3	1	0	2	4
UMA23107T	Number Theory	3	1	0	2	4
UMA23108T	Real Analysis	3	1	0	2	4
UMA23109T	Numerical Analysis	3	1	0	2	4
UMA23110T	Abstract Algebra	3	1	0	2	4
UMA23111T	Complex Analysis	3	1	0	2	4
UMA23112T	Mechanics	3	1	0	2	4
UMA23113T	Linear Algebra	3	1	0	2	4
UMA23114T	Fluid Dynamics	3	1	0	2	4
UMA23115T	Neural Networks and Numerical Optimization	3	1	0	2	4
UMA23116T	Research Methodology	3	1	0	2	4
UMA23117T	Functional Analysis	3	1	0	2	4
UMA23118J	Object Oriented Programming in C++	3	0	2	2	4
UMA23119T	Topology	3	1	0	2	4
UMA23120T	Time Series Analysis	3	1	0	2	4
	Total Learning Credits					**80**

2. Discipline Specific Elective Courses (D) (5 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UMA23D01T	Fuzzy Mathematics	3	1	0	2	4
UMA23D02T	Cryptography					
UMA23D03T	Astronomy	3	1	0	2	4
UMA23D04T	Graph Theory					
UMA23D05T	Financial Mathematics	3	1	0	2	4
UMA23D06T	Mathematical Modelling					
UMA23D07T	Statistics	3	1	0	2	4
UMA23D08T	Theory of Computation					
UMA23D09T	Operations Research	3	1	0	2	4
UMA23D10T	Combinatorics					
	Total Learning Credits					**20**

3. Generic Elective Courses (G) (9 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
ULT23G01J	Tamil-I	2	0	2	2	3
ULH23G01J	Hindi-I	2	0	2	2	
ULF3G01J	French-I	2	0	2	2	
ULT23G02J	Tamil-II	2	0	2	2	3
ULH23G02J	Hindi-II	2	0	2	2	
ULF23G02J	French-II	2	0	2	2	
UMA23G01T	Sampling theory	3	1	0	2	4
UMA23G02T	Data Base Management System					
UMA23G03T	Design of Experiments	3	1	0	2	4
UMA23G04T	Data Structures and Algorithms					
UMA23G05T	Queuing Theory and Reliability	3	1	0	2	4
UMA23G06T	Cloud Computing					
UMA23G07J	Programming in R	3	0	2	2	4
UMA23G08J	Machine Learning					
UMA23G09T	Stochastic Process	3	1	0	2	4
UMA23G10T	Statistical Quality Control					
UCY23G01J	Basic Chemistry	3	0	3	2	4
UPY23G01J	Allied Physics	3	0	3	2	4
	Total Learning Credits					**34**

4. Skill Enhancement Courses(S) (5 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UCD23S01L	Quantitative Aptitude and Logical Reasoning	0	0	2	2	1
UCD23S02T	Verbal Ability and Skill Development	2	0	0	2	2
UMA23S01L	C Programming	0	0	2	2	1
UMA23S02J	PYTHON Programming	1	0	2	2	2
UMA23S03L	Mathematical Software SCILAB	0	0	2	2	1
	Total Learning Credits					**7**

5. Ability Enhancement Courses (AE)
(4 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
ULE23AE1T	English	4	0	0	2	4
ULT23AE1J	Applied Tamil – I	1	0	2	2	2
ULH23AE1J	Applied Hindi - I					
ULF23AE1J	French for specific purpose-I					
ULT23AE2J	Applied Tamil – II	1	0	2	2	2
ULH23AE2J	Applied Hindi - II					
ULF23AE2J	French for specific purpose-II					
UES23AE1T	Environmental Studies	3	0	0	2	3
	Total Learning Credits					11

6. Value Addition Course (V)
(4 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UCD23V01T	Universal Human Values	2	0	0	2	2
UEN23V01L	Communication Skills	0	0	4	2	2
UCD23V02T	Industry Oriented Employability Skills for Science	2	0	0	2	2
UCD23V05T	Career Readiness and Professional Skills	2	0	0	2	2
	Total Learning Credits					***8***

7. Internship/Apprenticeship / Project/ Community Outreach (IAPC)
(6 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UMA23P01L	Internship - I	0	0	0	0	1
UMA23P02L	Internship - II	0	0	0	0	1
UMA23P03L	Mini Project	0	0	4	0	2
UMA23P04L	Internship - III	0	0	0	0	2
UMA23P05L	Project Phase-I	0	0	8	2	4
UMA23P06L	Project Phase-II	0	0	12	2	6
	Total Learning Credits					16

8.Mandatory Courses (M)
(2 Courses)

Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UNS23M01L	NSS	0	0	0	0	0
UNC23M01L	NCC					
UNO23M01L	NSO					
UYG23M01L	YOGA					
UMI23M01L	My India Project	0	0	0	0	0
	Total Learning Credits					***0***

8. Implementation Plan

Semester - I						
Course Code	Course Title	Hours/ Week L	T	P	O	C
ULT23G01J	Tamil-I	2	0	2	2	3
ULH23G01J	Hindi-I	2	0	2	2	
ULF23G01J	French-I	2	0	2	2	
ULE23AE1T	English	4	0	0	2	4
UMA23101T	Algebra and Geometry	3	1	0	2	4
UMA23102T	Calculus	3	1	0	2	4
UMA23103T	Ordinary Differential Equations	3	1	0	2	4
UCD23S01L	Quantitative Aptitude and Logical Reasoning	0	0	2	2	1
UCD23V01T	Universal Human Values	2	0	0	2	2
Total Learning Credits						22
Total number of hours/Week						24

Semester - II						
Course Code	Course Title	Hours/ Week L	T	P	O	C
ULT23G02J	Tamil-II	2	0	2	2	3
ULH23G02J	Hindi-II	2	0	2	2	
ULF23G02J	French-II	2	0	2	2	
UES23AE1T	Environmental Studies	3	0	0	2	3
UMA23104T	Probability and Probability Distributions	3	1	0	2	4
UMA23105T	Multivariate Calculus	3	1	0	2	4
UMA23106T	Partial Differential Equations	3	1	0	2	4
UCD23S02T	Verbal Ability and Skill Development	2	0	0	2	2
UEN23V01L	Communication Skills	0	0	4	2	2
UNS23M01L	NSS	0	0	0	0	0
UNC23M01L	NCC					
UNO23M01L	NSO					
UYG23M01L	YOGA					
Total Learning Credits						22
Total number of hours/Week						25

Semester - III						
Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UMA23107T	Number Theory	3	1	0	2	4
ULT23AE1J	Applied Tamil – I	1	0	2	2	2
ULH23AE1J	Applied Hindi – I					
ULF23AE1J	French for specific purpose-I					
UMA23D01T	Fuzzy Mathematics	3	1	0	2	4
UMA23D02T	Cryptography					
UCY23G01J	Basic Chemistry	3	0	3	2	4
UPY23G01J	Allied Physics	3	0	3	2	4
UMA23S01L	C Programming	0	0	2	2	1
UMA23P01L	Internship - I	0	0	0	0	1
UCD23V02T	Industry Oriented Employability Skills for Science	2	0	0	2	2
Total Learning Credits						22
	Total number of hours/Week					27

Semester - IV						
Course Code	Course Title	Hours/ Week				C
		L	T	P	O	
UMA23108T	Real Analysis	3	1	0	2	4
UMA23109T	Numerical Analysis	3	1	0	2	4
UMA23110T	Abstract Algebra	3	1	0	2	4
ULT23AE2J	Applied Tamil – II	1	0	2	2	2
ULH23AE2J	Applied Hindi - II					
ULF23AE2J	French for specific purpose-II					
UMA23G01T	Sampling theory	3	1	0	2	4
UMA23G02T	Data Base Management System					
UMA23S02J	PYTHON Programming	1	0	2	2	2
UCD23V05T	Career Readiness and Professional Skills	2	0	0	2	2
UMI23M01L	My India Project	0	0	0	0	0
Total Learning Credits						22
	Total number of hours/Week					24

Semester - V						
Course Code	Course Title	Hours/ Week				
		L	T	P	O	C
UMA23111T	Complex Analysis	3	1	0	2	4
UMA23112T	Mechanics	3	1	0	2	4
UMA23113T	Linear Algebra	3	1	0	2	4
UMA23D03T	Astronomy	3	1	0	2	4
UMA23D04T	Graph Theory					
UMA23G03T	Design of Experiments	3	1	0	2	4
UMA23G04T	Data Structures and Algorithms					
UMA23S03L	Mathematical Software SCILAB	0	0	2	2	1
UMA23P02L	Internship - II	0	0	0	0	1
Total Learning Credits						22
	Total number of hours/Week					22

Semester - VI						
Course Code	Course Title	Hours/ Week				
		L	T	P	O	C
UMA23114T	Fluid Dynamics	3	1	0	2	4
UMA23115T	Neural Networks and Numerical Optimization	3	1	0	2	4
UMA23116T	Research Methodology	3	1	0	2	4
UMA23D05T	Financial Mathematics	3	1	0	2	4
UMA23D06T	Mathematical Modelling					
UMA23G05T	Queuing Theory and Reliability	3	1	0	2	4
UMA23G06T	Cloud Computing					
UMA23P03L	Mini Project	0	0	4	0	2
Total Learning Credits						22
	Total number of hours/Week					24

Total Learning Credits **132**

Semester – VII						
Course Code	Course Title	Hours/ Week				
		L	T	P	O	C
UMA23117T	Functional Analysis	3	1	0	2	4
UMA23118J	Object Oriented Programming in C++	3	0	2	2	4
UMA23D07T	Statistics	3	1	0	2	4
UMA23D08T	Theory of Computation					
UMA23G07J	Programming in R	3	0	2	2	4
UMA23G08J	Machine Learning					
UMA23P04L	Internship - III	0	0	0	0	2
UMA23P05L	Project Phase-I	0	0	8	2	4
Total Learning Credits						22
Total number of hours/Week						26

Semester - VIII						
Course Code	Course Title	Hours/ Week				
		L	T	P	O	C
UMA23119T	Topology	3	1	0	2	4
UMA23120T	Time Series Analysis	3	1	0	2	4
UMA23D09T	Operations Research	3	1	0	2	4
UMA23D10T	Combinatorics					
UMA23G09T	Stochastic Process	3	1	0	2	4
UMA23G10T	Statistical Quality Control					
UMA23P06L	Project Phase-II	0	0	12	2	6
Total Learning Credits						22
Total number of hours/Week						28

Total Learning Credits 176

Courses for earning Additional Credits

Course Code	Course Title	Hours/ Week				
		L	T	P	O	C
Semester – II						
UCD23P01L	Internship Report– I	0	0	8	0	4
UCD23P02L	Project Work – I					
UCD23P03L	Apprenticeship – I					
Semester – IV						
UCD23P04L	Internship Report– II	0	0	8	0	4
UCD23P05L	Project Work – II					
UCD23P06L	Apprenticeship – II					
	Total Learning Credits	**0**	**0**	**8**	**0**	**4**

Note : Those students who decide to exit at the end of the First year shall register for any one of the courses mentioned under Semester – II; and decide to exit at the end of the Second year shall register for any one of the courses mentioned under Semester – IV in the above list.

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
UMA23101T	Algebra and Geometry	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23102T	Calculus	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23103T	Ordinary Differential Equations	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23104T	Probability and Probability Distributions	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23105T	Multivariate Calculus	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23106T	Partial Differential Equations	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23107T	Number Theory	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23108T	Real Analysis	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23109T	Numerical Analysis	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23110T	Abstract Algebra	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23111T	Complex Analysis	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23112T	Mechanics	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23113T	Linear Algebra	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23114T	Fluid Dynamics	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23115T	Neural Networks and Numerical Optimization	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23116T	Research Methodology	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23117T	Functional Analysis	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23118J	Object Oriented Programming in C++	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23119T	Topology	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23120T	Time Series Analysis	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D01T	Fuzzy Mathematics	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D02T	Cryptography	H	-	-	H	-	-	-	M	-	-	-	H	-	-	-
UMA23D03T	Astronomy	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D04T	Graph Theory	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D05T	Financial Mathematics	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D06T	Mathematical Modelling	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D07T	Statistics	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D08T	Theory of Computation	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D09T	Operations Research	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23D10T	Combinatorics	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
ULT23G01J	Tamil-I	H	M	H	H	H	H	M	H	H	M	H	H	M	H	H
ULH23G01J	Hindi-I	H	H	H	H	H	H	M	H	H	H	H	H	M	H	H
ULF23G01J	French-I	H	H	H	M	H	H	M	H	H	H	H	H	M	H	H
ULT23G02J	Tamil-II	H	M	H	H	H	H	M	H	H	M	H	H	M	H	H
ULH23G02J	Hindi-II	H	H	H	H	H	H	M	H	H	H	H	H	M	H	H
ULF23G02J	French-II	H	H	M	H	H	H	H	H	M	H	H	H	M	H	H
UMA23G01T	Sampling theory	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G02T	Data Base Management System	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G03T	Design of Experiments	H	-	-	H	-	-	-	M	-	-	-	H	-	-	-
UMA23G04T	Data Structures and Algorithms	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G05T	Queuing Theory and Reliability	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G06T	Cloud Computing	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G07J	Programming in R	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G08J	Machine Learning	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23G09T	Stochastic Process	H	-	-	H	-	-	-	M	-	-	-	H	-	-	-
UMA23G10T	Statistical Quality Control	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UCY23G01J	Basic Chemistry	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UPY23G01J	Allied Physics	H	H	-	-	-	-	-	M	-	H	-	-	-	-	-
UCD23S01L	Quantitative Aptitude and Logical Reasoning	H	M	M	L	-	M	-	M	H	L	H	L	-	-	-
UCD23S02T	Verbal Ability and Skill Development	H	M	M	L	-	M	-	M	H	L	H	L	-	-	-
UMA23S01L	C Programming	-	H	-	-	-	-	-	M	-	H	-	-	-	-	H
UMA23S02J	PYTHON Programming	H	-	H	-	-	-	-	M	-	H	-	-	-	-	-
UMA23S03L	Mathematical Software SCILAB	H	H	-	H	-	-	-	M	-	-	-	H	-	-	-
ULE23AE1T	English	H	-	H	-	H	H	-	M	H	-	H	H	-	-	-
ULT23AE1J	Applied Tamil – I	H	M	H	H	H	H	M	H	H	M	H	H	M	H	H
ULH23AE1J	Applied Hindi - I	H	H	H	H	H	H	M	H	H	H	H	H	M	H	H

ULF23AE1J	*French for specific purpose-I*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
ULT23AE2J	*Applied Tamil – II*	*H*	*M*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*M*	*H*	*H*	*M*	*H*	*H*
ULH23AE2J	*Applied Hindi - II*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*
ULF23AE2J	*French for specific purpose-II*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*M*	*H*	*H*
UES23AE1T	*Environmental Studies*	*H*	-	*H*	-	*H*	*H*	-	*M*	*H*	-	*H*	*H*	-	-	-
UCD23V01T	*Universal Human Values*	*H*	*M*	*M*	*L*	-	*M*	-	*M*	*H*	*L*	*H*	*L*	-	-	-
UEN23V01L	*Communication Skills*	*H*	*M*	*M*	*L*	-	*M*	-	*M*	*H*	*L*	*H*	*L*	-	-	-
UCD23V02L	*Industry Oriented Employability Skills for Science*	*H*	*M*	*M*	*L*	-	*M*	-	*M*	*H*	*L*	*H*	*L*	-	-	-
UCD23V05L	*Career Readiness and Professional Skills*	*H*	*M*	*M*	*L*	-	*M*	-	*M*	*H*	*L*	*H*	*L*	-	-	-
UMA23P01L	*Internship – I*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UMA23P02L	*Internship – II*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UMA23P03L	*Mini Project*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UMA23P04L	*Internship - III*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UMA23P05L	*Project Phase-I*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UMA23P06L	*Project Phase-II*	-	H	-	H	-	-	-	-	-	H	H	-	-	-	-
UNS23M01L	*NSS*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNC23M01L	*NCC*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNO23M01L	*NSO*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UYG23M01L	*YOGA*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UMI23M01L	*My India Project*	H	H	-	H	-	-	-	-	-	-	-	H	-	-	-

10. Structure of UG Courses in Mathematics

Distribution of different Courses in each semester with their credits for B.Sc. (Mathematics)

Semester	Compulsory Core Courses (CC) (Credit /Course)	Discipline Specific Elective (DSE) (Credit /Course)	Generic Elective (GEC) (Credit /Course)	Skill Enhancement Course (SEC) Life skills (Jeevan Kaushal) (Credit /Course)	Ability Enhancement (AE) (Credit /Course) (Credit /Course)	*Value Addition Course (V)* (Credit /Course)	Internship/ Apprenticeship / Project/ Community Outreach (IAPC) (Credit /Course)	Mandatory (M) (Credit /Course)	Total Credits
Sem I	CC-1 (4) CC-2 (4) CC-3 (4)	-	GE-1(3)	SEC-1(1)	AE-1(4)	V-1 (2)	-	-	**22**
Sem II	CC-4 (4) CC-5 (4) CC-6(4)	-	GE-2(3)	SEC-2(2)	AE-2(3)	V-2(2)	-	M1-(0)	**22**
Sem III	CC-7(4)	DSE-1(4)	GE-3(4) GE-4(4)	SEC-3(1)	AE-4(2)	V-3 (2)	IAPC-1(1)		**22**
Sem IV	CC-8 (4) CC-9 (4) CC-10(4)	-	GE-5(4)	SEC-4(2)	AE-4(2)	V-4(2)	-	M-2(0)	**22**
Sem V	CC-11(4) CC-12(4) CC-13(4)	DSE-2(4)	GE-6(4)	SEC-5(1)	-	-	IAPC-2(1)	-	**22**
Sem VI	CC-14(4) CC-15(4) CC-16(4)	DSE-3(4)	GE-7(4)	-	-	-	IAPC-3(2)	-	**22**
Sem VII	CC-17(4) CC-18(4)	DSE-4(4)	GE-8(4)	-	-	-	IAPC-4(2) IAPC-5(4)	-	**22**
Sem VIII	CC-19(4) CC-20(4)	DSE-5(4)	GE-9(4)	-	-	-	IAPC-6(6)	-	**22**
Total Credits	**80**	**20**	**34**	**7**	**11**	**8**	**16**	**0**	**176**

SEMESTER - I

Course Code	ULT23G01J	Course Name	Tamil - I	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*மரபிலிருந்து மாற்றம் பெற்ற புதுக்கவிதை மரபின் சிந்தனைகளை அறியச் செய்தல்*			
CLR-2 :	புதுக்கவிதையின் வழி மனித வாழ்வியல் விழுமியங்களைத் தெரியச் செய்தல்			
CLR-3 :	சிற்றிலக்கியங்கள், காப்பியங்கள் கற்பிக்கும் தமிழ்ச் சமூகத்தின் வாழ்வியலை அறியச் செய்தல்			
CLR-4 :	நவீன தமிழ் இலக்கிய வளர்ச்சி வரலாற்றைப் புரியச் செய்தல்			
CLR-5 :	*மொழிப் பயிற்சி வழி மொழியின் பல்வேறு நுட்பங்களைத் தெரியச் செய்தல்*			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					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 :	புதுக்கவிதை உருவாக்கித் தந்த புதிய சிந்தனைக் களங்களை அறிந்துகொள்ளுதல்	2	75	60	H	L	H	M	H	H	L	M	H	M	L	H	-	-	-
LCLO-2 :	*நவீன கவிதைகள் வழி மாற்றம் பெற்று வரும் மானுட விழுமியங்களைத் தெரிந்துகொள்ளுதல்*	2	80	70	H	M	H	L	M	H	L	H	M	L	H	H	-	-	-
CLO-3 :	*தமிழ்ச்சமூகத்தின் இடைக்கால வாழ்வியல் முறைகளை உணர்ந்துகொள்ளுதல்*	2	70	65	H	L	H	M	H	H	M	H	L	H	M	H	-	-	-
CLO-4 :	*நவீன இலக்கிய வரலாறு வழி தமிழ்க் கல்வி வரலாறு, சமூக வரலாறு பெற்ற வளர்ச்சி நிலைகளைத் தெரிந்துகொள்ளுதல்*	2	70	70	H	M	H	L	H	M	M	H	H	L	H	H	-	-	-
CLO-5 :	மொழியின் நுட்பங்களை அறிந்து மொழி ஆளுமையோடு செயல்பட அறிந்துகொள்ளுதல்	2	80	70	H	M	H	H	M	H	L	M	H	L	H	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*தமிழ் இலக்கியத்தின் வளர்ச்சிப் போக்குகள்*	*நவீன கவிதை தோற்றம்*	*தமிழரின் வீரமரபு*	*சிற்றிலக்கியத் தோற்றம்*	*தமிழ் உரைநடை மரபில் உ.வே.சா.*
	SLO-2	*இலக்கிய உத்திகள்*	*நவீன கவிதை வரலாறு*	*போர் விழுமியங்கள்*	*சிற்றிலக்கிய வகைமை*	***ராஜ வைத்தியம்***
S-2	SLO-1	*தமிழ்க் கவிதை மரபு*	*நவீன கவிதை செல்நெறிகள்*	*பரணி அறிமுகம்*	*சிற்றிலக்கியங்கள்*	*வைத்தியர்களின் சிறப்பு*

	SLO-2	*காலந்தோறும் கவிதையின் கரு*	*செல்நெறிகளில் கோட்பாடுகள்*	*பரணி இலக்கியங்கள்*	*முதன்மைச் சிற்றிலக்கியங்கள் –*	***கழனியூரன் – அறிமுகம்***
S-3	SLO-1	*காலந்தோறும் கவிதையின் கட்டமைப்பு*	*கவிதை மொழி*	*கலிங்கத்துப்பரணி* 477,490	*பிள்ளைத்தமிழ் -உலா - தூது*	*சிறுதெய்வ வழிபாடு*
	SLO-2	*தற்கால இலக்கியம்*	*நவீன கவி ஆளுமைகள்*	*தலைவனின் வீரம்*	*புதுக்கவிதையில் சமூகம்*	***பொன் காத்த ஐயனார்***
S-4	SLO-1	*புதுக்கவிதை உருவாக்கம்*	*பெண் கவிஞர்கள்*	*தமிழ் இலக்கிய மரபில் தூது*	*புதுக்கவிதையும் இதழ்களும்*	*விருந்து – கள்ளர் செயல்கள்*
	SLO-2	*புதுக்கவிதை வளர்ச்சிநெறிகள்*	*கவிதையில் நாட்டுப்புற வடிவம்*	*தூது இலக்கியங்கள்*	*மணிக்கொடி இதழ்*	*பிழை நீக்கி எழுதுதல்*
S-5	SLO-1	*பாரதியார் – புதுக்கவிதையின் அடையாளம்*	*இளம்பிறை – அம்மா*	*தமிழ் விடு தூது* (184 – 186)	*எழுத்து இதழ்*	*எழுத்துப் பிழை*
	SLO-2	*பாரதியார் பன்முக ஆளுமைத்திறன்*	*பெண்களின் கல்வி நிலை*	*தமிழின் பெருமை*	*வானம்பாடி இதழ்*	*தொடர்பிழை*
S-6	SLO-1	*பாரத தேசம்*	*பெண் அடக்குமுறை*	*செய்யுள் மரபில் கலம்பகம்*	*சிறுகதை தோற்றம்*	*உயர்திணை, அஃறிணை*
	SLO-2	*பாரததேசத்தின் வளம்*	*ப. கல்பனா – கீறல் விழுந்த மாலைக் காலங்கள்*	*கலம்பக இலக்கியங்கள்*	*சிறுகதை வளர்ச்சி*	*பிறமொழிச் சொற்கள் வரலாறு*
S-7	SLO-1	*வெள்ளிப் பனிமலையின் மீதுலவுவோம்…*	*ஆண் பெண் சமத்துவம்*	*நந்திக் கலம்பகம்-வானுறு மதியை* (110)	*சிறுகதை – வரலாறு*	*பிறமொழிச் சொற்களை நீக்கி எழுதுதல்*
	SLO-2	20 *ஆம் நூற்றாண்டுக் கவிதை மரபில் பாரதிதாசன்*	*விளிம்புநிலை வாழ்வியல்*	*கையறுநிலை*	*சிறுகதை ஆசிரியர்கள்*	*ஷ, ஜ, ஸ, ஹ மாற்றொலிகள்*
S-8	SLO-1	*பாரதிதாசன் - அழகின் சிரிப்பு*	*திருநங்கை குணவதி - சமூகப்பார்வை*	*குறவஞ்சி அறிமுகம்*	*இதழ்களும் சிறுகதையும்*	*தமிழ் இலக்கண நுட்பங்கள்*
	SLO-2	*ஆல் - ஆயிரம் கிளைகள் கொண்ட அடிமரம்*	*திருநர்களும் சாதனைகளும்*	*குறவஞ்சி இலக்கியங்கள்*	*புதினம் தோற்றம்*	*இலக்கணமும் பயன்பாடும்*
S-9	SLO-1	*இயற்கையின் அழகியல்*	*புலம்பெயர் வாழ்வியல்*	*குற்றாலக் குறவஞ்சி – ஆடுமர வீனுமணி* (3)	*தொடக்கக்காலப் புதினங்கள்*	*தமிழில் சொல் வகைகள்*
	SLO-2	*வானம்பாடியில் மு.மேத்தா*	*ஸ்மிளா ஸெய்யித் – புராதன ஊர்*	*மலையும் வாழ்வும்*	*புதினம் வளர்ச்சி*	*சொல்லும் பயன்பாடும்*
S-10	SLO-1	*மு.மேத்தா - கவிதையின் தனித்தன்மைகள்*	*புலம் பெயர் வாழ்வின் வலியும் நம்பிக்கையும்*	*காப்பிய இலக்கணம்*	*புதினத்தின் வகைமை*	*பெயர்ச்சொற்கள்*
	SLO-2	*மனிதனைத்தேடி – கவிதை*	*காலந்தோறும் கவிதை வடிவில் மாற்றங்கள்*	*காப்பிய வகைமைகள்*	*புதின ஆசிரியர்கள்*	*பெயர்ச்சொற்கள் அறிதல்*

S-11	SLO-1	மனிதநேயம்	ஹைக்கூ, லிமரைக்கூ, சென்ரியூ – தேர்ந்தெடுத்த கவிதைகள்	சிலப்பதிகாரம் – அறிமுகம்	தமிழ் இலக்கியத்தில் உரைநடைக்கூறுகள்	வினைச்சொற்கள்
	SLO-2	தமிழ்க் கவிதையில் சுற்றுச்சூழலியல்	ஹைக்கூ – மு.முருகேஷ்	கட்டுரைக்காதை	உரைநடையின் தோற்றம்	வினைச்சொற்கள் அறிதல்
S-12	SLO-1	பழனிபாரதியின் காடு	லிமரைக்கூ – ஈரோடு தமிழன்பன்	ஊழ்வினை	தமிழில் உரைநடை	தமிழில் பெயரடை, வினையடை
	SLO-2	இயற்கையும் சமூக சமத்துவ வாழ்வியலும்	சென்ரியூ – மாமதயானை	கோவலனின் முற்பிறப்பு வரலாறு	உரைநடை வளர்த்த அறிஞர்கள்	பெயரடை, வினையடை அறிதல்

Learning Resources	1. ***முல்லைக்காடு, தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள், எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம், காட்டாங்குளத்தூர்***, 603203, 2023 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%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. P.R.Subramanian, Director, Mozhi Trust, Thiruvanmiyur, Chennai – 600 041.	*1. Dr. V. Dhanalakshmi, Associate Professor, Subramania Bharathi School of Tamil Language & Literaturel, Pondicherry University, Pondicherry*	*1. Dr. B.Jaiganesh, Associate Professor & Head, Dept. of Tamil, FSH, SRMIST, KTR.*
		2. Dr. R. Ravi, Assistant Professor and Head, Dept. of Tamil, FSH, SRMIST, VDP.
		3. Mr. G. Ganesh, Assistant Professor, Dept. of Tamil, FSH, SRMIST, RMP.
		4. Dr. T.R.Hebzibah beulah Suganthi, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.
		5. Dr. S.Saraswathy, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.

Course Code	ULH23G01J	Course Name	HINDI-I	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Discipline	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 Communicate in Hindi without any inhibition*																		
CLR-2 :	*To appreciate the Hindi Language in its various forms*																		
CLR-3 :	*To analyze the different writing styles*																		
CLR-4 :	*To display moral and social values in the field of social Responsibility and Integrity*																		
CLR-5 :	*To be willing listeners and Translators-where need be*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*To Understand the Philosophy of life and living through Stories*	*2*	*75*	*80*	*H*	*H*	*H*	*M*	*L*	*H*	*L*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-2 :	*To Examine Travelogue writing and Sketch*	*2*	*80*	*90*	*H*	*H*	*H*	*M*	*L*	*H*	*H*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-3 :	*To Identify Irony and essay based writing*	*2*	*75*	*95*	*H*	*H*	*M*	*L*	*H*	*H*	*M*	*H*	*M*	*M*	*H*	*H*	-	-	-
CLO-4 :	*Evaluate the various social issues depicted in the prose*	*2*	*80*	*90*	*H*	*H*	*L*	*H*	*M*	*H*	*L*	*H*	*H*	*M*	*H*	*H*	-	-	-
CLO-5 :	*To Understand the basic and fundamental principal of Translation*	*2*	*85*	*90*	*M*	*H*	*M*	*H*	*L*	*H*	*H*	*L*	*H*	*M*	*H*	*H*	-	-	-

Duration (hour)		**12**	**12**	12	**12**	**12**
S-1	SLO-1	*KAHANI*	*REKHACHITRA & YATRAVITRANT*	*NIBANDH*	*NATAK*	*ANUVAD& PARIBHASHIK SHABDAVALI*
	SLO-2	*AVDHARNA*	*VDHARNA*	*IBANDH KI AVDHARNA*	*AVDHARNA*	*RTH*
S-2	*SLO-1*	*SWARUP*	*WAROOP*	*WARUP*	*NATAK KA SWARUP*	*ARIBHASHA*
	SLO-2	*PARIBHASHA*	*HUMIKA*	*ARIBHASHA*	*PARIBHASHA*	*WARUP*
S-3	*SLO-1*	*KAHANI KE TATVA*	*MAHATVA*	*MAHATVA*	*TATWA*	*RAKAR*
	SLO-2	*KAHANI KA MAHATVA*	*DDESHYA*	*DDESHYA*	*PRAKAR*	*MAHATVA*
S-4	*SLO-1*	*PARIKSHA- PREMCHAND*	*ISHA- EKHACHITRA*	*UTAJ- NIBANDH AJARI PRASHAD DIVEDI*	*UDDESHYA*	*DDESHYA*
	SLO-2	*KAHANI KA PARICHAY*	*EKHIKA PARICHAY*	*EKHIKA PARICHAY*	*RANGMANCH KA PARICHAY*	*NUVAD KA PRAYOJAN*
S-5	*SLO-1*	*VISLESHAN*	*ATH KA VISHLESHAN*	*ATH KA MAHATVA*	*NATAK KA MAHATVA*	*NUVAD KA PRAYOG*

	SLO-2	EMANDARI KA MAHATVA	URU SHISHYA KA AMBANDH	IPRIT PARISHTHITIYON ME JEEVAN KI ASH	PRAYOJAN	HROT BHASHA KA GYAN
S-6	SLO-1	HONHARI KA PARICHAY	GURU KE PRATI SMARPAN BHAVANA	MANAV KI AKANKSHAYEN	ANDHER NAGRI-(NATAK) BHARTENDU HARISHCHAND	LAKSHYA BHASHA KA GYAN
	SLO-2	UDDESHYA	PATH KA MAHATVA	SHANGHARSHIL JEEVAN	LEKHAK PARICHAY	ANUVAD KA DAYITVA
S-7	SLO-1	MALBE KA MALIK- MOHAN RAKESH	HELE PAR HIMALAY (YATRAVITRANT)	SANGHARSH KA PARINAM	NATAK KA VISLESHAN	ANUVAD KA ABHYASH
	SLO-2	LEKHAK PARICHAY	LEKHAK PARICHAY	BHOLARAM KA JEEV-(VYANGYA) HARISHANKAR PARSHAI	NATAK ABHINAY	ANGREJI SE HINDI
S-8	SLO-1	BATWARE KA YATHARTH VARNAN	YATRAVITRANT KA MAHATVA	VYANGYA KI AVADHARNA	LALCH KA DUSHPARINAM	HINDI SE ANGREJI
	SLO-2	TATKALIN PARISHTHITI KA VARNAN	YATRA KA YATHARTH CHITRAN	MAHATVA	SHISHYA KI AGYANTA	ANUVAD PRIYOJNA KARYA
S-9	SLO-1	APNI MITTI SE LAGAV	PATH KA VISLESHAN	LEKHAK PARICHAY	GURU SHISHYA SAMBANDH	PUNRIKSHAN
	SLO-2	RAJNITIK VIDWESH KA PARINAM	HIMALAY KA VARNANA	PATH KA VIHLESHAN	HASHYA VYANGY SE AVAGAT KARANA	VIVIDH PRAYOG
S-10	SLO-1	PROPKAR KI BHAVANA	HIMALAY KA LOK JEEVAN	MADHYAVARGI PARIVAR KI STHITI	DURDRISHTIHIN	PARIBHASHIK SHABDAVALI
	SLO-2	KAHANI PATH	LOK SAMASYA	SARKARI TANTRA KA KHOKHLA RUP	MAHATTAKANKSHI KA DUSHPARINAM	ATI MAHTVAPURN SHABD
S-11	SLO-1	KAHANI KA VISHLESHAN	UDDESHYA	PAURANIK KATHA KA CHITRAN	GURU KI AVAGYA KA DUSHPARINAM	TAKANIKI SHABDAVALI KA MHATVA
	SLO-2	PRASHO KI CHARCHA	PRASHNA ABHYASH	SANVEDANSHIL BHAVANA	TATKALIN SAMAJIK VYAVASTHA KI CHARCHA	HINDI SE ANGREZI SHABD
S-12	SLO-1	PRASHN ABHYASH	PATH PRICHARCHA	PARICHARCHA	PARICHARCHA	ANGREZI SE HINDI SHABD
	SLO-2	KAHANI KA UDDESHYA	MAHATVAPURN BIBDUON KI CHARCHA	PRASHANA ABHYASH	PRASHNABHYASH	SHABDAVALI KI AVSHYAKTA

Learning Resources	***Edited Book: ""SAMANYA HINDI", SRIJONLOK PUBLICATION, 2023, New Delhi.*** 1. KABIR – HAZARI PRASAD DWEDI 2. SURDAS – RAM CHANDRA SHUKL 3. BHAKTI ANDOLAN AUR SURDAS KA KAVYA – MANAGER PANDEY 4. BIHARI – VISHVNATH PRASAD MISHR 5. Aadhunik Vigyapan aur Jansampark – Taresh Bhatia

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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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	**Experts from Higher Technical Institutions**	**Internal Experts**
Shri. Santosh Kumar Editor : Srijanlok Magazine Place: Vashishth Nagar, Ara – 802301	*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
		4, Dr.Nisha Murlidharan Assistant Professor, VDP,SRM IST

Course Code	ULF23G01J	Course Name	French-I	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Extend and expand their savoir-faire through the acquisition of current scenario*			
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			

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 :	*To acquire knowledge about French language*	*2*	*75*	*80*	*H*	*M*	*H*	*H*	*M*	*H*	*H*	*L*	*M*	*M*	*H*	*L*	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*90*	*M*	*H*	*L*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-3 :	*To develop content using the features in French language*	*2*	*85*	*75*	*H*	*H*	*L*	*M*	*H*	*M*	*L*	*H*	*M*	*M*	*H*	*H*	-	-	-
CLO-4 :	*To interpret the French language into other language*	*2*	*75*	*80*	*H*	*L*	*M*	*H*	*M*	*H*	*H*	*M*	*L*	*H*	*M*	*L*	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*75*	*M*	*H*	*H*	*L*	*M*	*M*	*H*	*H*	*M*	*L*	*H*	*M*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	**Contacts**	Les verbes du premier groupe	**Qu'est-ce qu'ils font ?**	**Portraits**	Les verbes du deuxième groupe –
	SLO-2	**Emma la championne**	**Les exemples**	**Les exemples**	**Un casting**	Les exemples
S-2	SLO-1	Les nombres à partir de 31	La liaison	**Où est mon sac**	Les exemples	Les pronoms personnels toniques
	SLO-2	Les activités	Les activités	Les exemples	Les activités	Les exemples
S-3	SLO-1	Les pays	Entrer en contact	Quelques objets	**Le Petit Spirou**	Les verbes faire et lire
	SLO-2	les nationalités	Les activités	Les exemples	Les activités	Les exemples
S-4	SLO-1	Les jours de la semaine	Présenter et se présenter	Les professions	L'aspect physique	*Les Sons*
	SLO-2	Les jours	Les activités	La fiche d'identité	Les activités	Les exemples

S-5	**SLO-1**	Les mois de l'année	Demander et dire la date	La formation du féminin (2)	Le caractère	*Décrire l'aspect physique*
	SLO-2	Les activités	Les activités	La phrase interrogative partielle –	Les exemples	*Décrire le caractère*
S-6	**SLO-1**	Les animaux domestiques	une rencontre.	*Qu'est-ce que c'est ?*	les états d'âme	*Demander et dire l'heure*
	SLO-2	Les activités	Les activités	*Qui est-ce ?*	Les activités	Les exemples
S-7	**SLO-1**	La famille (1)	Contacts	*C'est / Il est (1)*	Les prépositions de lieu (1)	*Elle est comment ?*
	SLO-2	Les activités	Les activités	**Les exemples**	Les exemples	Les exemples
S-8	**SLO-1**	La formation du féminin (1)	Emma la Championne	La phrase négative (1)	La famille (2)	*Portraits*
	SLO-2	Les activités	Les activités	Les exemples	Les activités	Les exemples
S-9	**SLO-1**	Les adjectifs possessifs	Mots et expressions	Les verbes aller et venir	La formation du féminin	*Mots et Expressions*
	SLO-2	Les exemples	Les activités	L'élision	Les activités	Les activités
S-10	**SLO-1**	La phrase interrogative	Grammaire -	Les formules de politesse	La formation du pluriel (2)	*Grammaire.*
	SLO-2	Les exemples	**Les** exemples	Demander des informations personnelles	Les activités	Les exemples
S-11	**SLO-1**	Les activités	Communication	C'est qui ?	*Il y a*	Les activités
	SLO-2	Les nombres	Les activités	Qu'est-ce qu'ils font ?	Les activités	*Communication*
S-12	**SLO-1**	intonation et *est-ce que*	*Les verbes du ER –groupe*	Mots et Expressions	Les articles contractés	Les activités
	SLO-2	Les exemples	Les exemples	Grammaire – Communication	Les exemples	Les exemples

Learning Resources	***Theory:*** ***1.*** **'' Nouvelle 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.*** ***3.*** *https://www.fluentu.com/blog/french/french-grammar* ***4.*** *https://www.elearningfrench.com/learn-french-grammar-online-free.html* ***5.*** *https://www.lawlessfrench.com/grammar* ***6.*** *https://blog.gymglish.com/2022/12/15/basic-french-grammar*

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 (5%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember Understand	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
Level 2	Apply Analyze	40%	50%	50%	40%	50%	50%	50%	50%	50%	-

Level 3	Evaluate	30%	20%	20%	30%	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. Mr. Kavaskar Danasegarane Process Expert Maersk Global Service Center Pvt. Ltd	*1. Dr. C.Thirumurugan Professor, Department of French, Pondicherry University*	*1. Mr. Kumaravel K. Assistant Professor & Head, SRMIST, KTR*
2.Mr. Sharath Raam Prasad Character Designer, Animaker Company Pvt.		*2. Mrs. Abigail, Assistant Professor, SRMIST, VDP*

Course Code	ULE23AE1T	Course Name	English	Course Category	AE	Ability Enhancement course	L	T	P	0	C
							4	0	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Department of English, FSH, SRMIST	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 :	Develop an understanding and sensibility of human consciousness through gender inclusive curriculum	Level of Thinking	Expected Proficiency (%)	Expected	Fundamental	Application of	Link with Related	Procedural	Skills in	Ability to Utilize	Skills in	Analyze,	Investigative	Problem Solving	Communication	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-2 :	Enhance the abilities of deeper understanding to stay with integrity with the fellow human beings																		
CLR-3 :	Develop the overall language competency of the learner																		
CLR-4 :	Develop proficient language skills																		
CLR-5 :	Learn to express the thoughts clearly, develop logical arguments and enhance the overall communication skills.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Analyze different literary texts to identify the representation of issues related to gender, and class	2	75	60	H	M	M	L	-	M	-	M	H	L	H	L	-	-	-
CLO-2 :	Apply critical thinking skills to analyze and respond to academic texts.	2	80	70	M	H	L	-	-	-	-	M	M	H	H	M	-	-	-
CLO-3 :	Critically evaluate and discuss contemporary issues through online articles.	2	70	65	M	M	M	-	L	L	-	H	M	H	H	L	-	-	-
CLO-4 :	Refine their general writing skills	2	70	70	H	M	L	-	M	H	-	-	-	-	H	L	-	-	-
CLO-5 :	Improve their language application skills	2	80	70	H	H	-	M	-	M	-	L	L	M	H	M	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to the poetry and the poet- Sukirtharani	Introduction to Short stories. Introducing the short story writer Katherine Mansfield.	Introduction to Creative Writing. Explaining the elements of creative writing.	Building the discourse- The significance of conversation and the key elements of discourse are the points of discussion in this class hour.	Reflecting the learning. -Review writing
	SLO- 2	Reading and recitation of the poem -Debt	Reading the story- The Doll's House	Stand-up comedy show -translate the audio content in English. (any regional language)	Art of conversation in digital and verbal discourse- Lee Mockobe's A Powerful Poem of what it means to be a Transgender. TEDX TALK- POEM RECITATION	Choosing the subject for reviewing.
S-2	SLO-1	Analysis and Critical interpretation of the poem.	Explaining the story through depiction of characters and representation of injustices.	Students- groups -Students belonging to States other than Tamilnadu	Reflecting on the style and the tone of the poem.	Planning to choose.

	SLO- 2	*Introduction to the poet Kalki Subramaniyam.*	*Analysis and critical interpretation of the short story Doll's House.*	*Practice the writing activity -creative ways of engaging in translation.*	*Practicing conversation*	*Understand the review process how effectively a review of any work can be done.*
S-3 – S-4	**SLO-1**	*Reading and recitation of the poem Phallus I cut.*	*Introduction to the writer Haruki Murakami.*	*Correction of errors- attempting to translate.*	*Introducing Content writing in Social Media- the importance of content writing.*	*Introducing the students to the review of the various works.*
	SLO- 2	*Analysis and Critical interpretation of the poem.*	*Reading the Confessions of a Shinawaga monkey.*	*Identifying equivalent terms to certain regional words - learn the art of translation.*	*.BLOG WRITING - Subtleties Of Workplace Inclusion: Mental Health And Queer Community- Salik Ansari.* .	*Reviewing -recorded -posted in the social media pages of SRMIST*
S-5	**SLO-1**	*Introduction to the poet Imtiaz Dharker*	*Discussion and analysis of the Confessions of a Shinawaga monkey.*	*Introducing famous art works and the contexts of creation.* *Salvador Dali- The Face of War* *Pablo Picasso- Guernica* *Edward Munch- The Scream* *Pieter Bruegel- The Tower of Babel*	*Writer's conversation with the readers - the blog in other blog articles.*	*Thoughtful conversation with your team member post the same in the official social media page of SRMIST.*
	SLO- 2	*Reading and reciting the poem Purdah 1*	*Introduction to Crystal Wilkinson*	*creative and/ or thoughtful writing - contemporary themes of modern day relevance*	*Practice blog writing*	*Choosing the team based on the abilities that are comfortable to match the peer members*
S-6	**SLO-1**	*Analysis and Critical interpretation of the poem- Purdah 1*	*Reading Endangered Species: Case 47401.*	*Students -writing abilities- building stories- a visual treat of variety of pictures.*	*Apprehending Life by reading the texts of influence- Chimamanda Ngozi Adiche's Notes on Grief- A BRIEF NOTE, We should all be Feminists- An Essay.*	*Choosing the topics for a thoughtful conversation*
	SLO- 2	*Reading and reciting the poem Purdah 2*	*Discussion and analysis of Endangered Species: Case 47401.*	*Elements of writing*	*Discussion- essay by the author -subjective depiction of life.* *Understand -subjective opinions -perspectives -*	*Planning and preparation for the script of conversation with a team member*
S-7 – S-8	**SLO-1**	*Analysis and Critical interpretation of the poem- Purdah 2*	*Introduction to C.S Lakshmi also known as Ambai.*	*Incorporate the elements of story in story writing.*	*Class discussion*	*Drafting , editing and revising the script of conversation and enacting the conversation with the team members*
	SLO- 2	*Introduction to the poet Arundathi Subramanian*	*Reading the short story- In a Forest, A Deer.*	*Practice -write stories -pictures given or shown .*	*Practising the task multiple times with all the students in the classroom.*	*Enactment -proper rehearsal -final performance - conversation- whole performance should be recorded.*
S-9	**SLO-1**	*Reading and reciting the poem- Home*	*Discussion and Analysis of In a Forest, A Deer.*	*A writing task to write a script is introduced in the classroom.*	*Interposing opinions in famous interviews-*	*The recording should be posted in the official media page and social handles of SRMIST.*
	SLO- 2	*Analysis and Critical interpretation of the poem- Home*	*Retrospecting the writing styles of the authors- Katherine Mansfield, Haruki Murakami, Crystal Wilkinson and Ambai.*	*creative scripts inspiring from the dialogues of their favourite films by changing the scenario to their own wish according to their own whims and fancies.*	*Interposing opinions in famous interviews- FII Interviews: Tasveer Co-Founder And Filmmaker Rita Meher On The Seattle Legislation, Minority Rights And The Fight Against Oppression- INTERVIEW*	*work for this social post - reflect on their experience of learning communicative English course and the testimonial has to be recorded and posted in the social media pages of SRMIST..*
S-10	**SLO-1**	*Recollection of study of the writing styles and intentions of the poets prescribed in the syllabus.*	*Revision- The Doll's House*	*Creative writing -writing news reports. recreated with new characters, places, scenes, incidents.*	*Students -enact as interviewer and interviewee and practice building the discourse.*	*Involving the students for the project work. Introducing what is project work and inculcating the interest -Giving instructions to do the project works -*
	SLO- 2	*Revision of the poems Debt and Phallus I cut*	*Revision- Confessions of a Shinawaga Monkey*	*Watch debate shows - summarising the arguments Enhance -descriptive writing skill.*	*Certain role plays like celebrity personalities, political personalities -conduct the interview and be the interviewer and interviewee.*	*Discussion of ideas and generation of creative ideas*
S 11 -	**SLO-1**	*Revision of the poems Purdah 1 and 2*	*Revison- Endangered Species: Case 47401*	*Practice the* improvement *of writing skill.*	*The art of conversation and the ability to build a discourse*	*1. Assignment on any piece of creative writing (OR)*

S 12						*2. Presentation- Mastering the art of Public Speaking. (OR)* *3. Project on compiling the real life influential events on gender inclusive issues and a presentation of the same. Interview Scripting /Blog writing.*
	SLO- 2	*Revision of the poem Hiome.*	*Revision- In a Forest, A Deer.*	*Repetitive practice and continuous assessment - writing skiills-master the writing skill.*	*The evaluation and assesment of the conversation - constructive feedbacks to the students.*	*Students can opt any of the project from the given choice.*

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

Level	Blooms 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
1	Remember Understand	30%	-	30%	-	30%	-	30%	-	30%	-
2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-
3	Evaluate Create	30 %	-	30%	-	30%	-	30 %	-	30%	-
	Total	100 %		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
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Ann Mariya Thomson ***RA2232105010015*** ***II M.A English Literature*** ***CSH, SRM IST*** ***az1160@srmist.edu.in***	***Dr. K S Antonysamy*** ***Associate Professor and Head, Dept. of English Loyola College*** ***Chennai*** ***antonysamyks@loyolacollege.edu***	***Dr. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*** ***Dr Anchal Sharma, Prof & Hod EFL SRMIST NCR Campus*** ***Dr T Sridevi, Assistant Professor English, FSH Ramapuram SRM*** ***Dr Shanmuga Priya, Assistant Professor SRMIST Trichirapalli Campus***

Course Code	UMA23101T	Course Name	Algebra and Geometry	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the relation between roots and coefficient of equations																		
CLR-2 :	Learn the concept of reciprocal equations																		
CLR-3 :	Study in detail the transformation of equations																		
CLR-4 :	To understand straight lines in three dimensions.																		
CLR-5 :	To gain knowledge about spheres, properties involving plane sections of a sphere.																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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 :	Know the fundamental application of theory of equations	4	85	80	*H*	-	*H*	*M*	-	-	-	-	-	-	-		-	-	-
CLO-2 :	Identify the roots of symmetric functions in terms of coefficients of third degree equations	4	85	80	*H*		*H*	*M*		-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understand the concept of different methods of finding the roots of a polynomials	4	85	80	*H*	-	*H*	*M*		-	-	-	-	-	-	-	-	-	-
CLO-4 :	Derive equation of straight lines in different forms and to understand the properties of straight lines	4	85	80	*H*	*M*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Solve problems in sphere and plane section of the sphere	4	85	80	H	M	*H*	*H*	-	-		-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to polynomial equations, Standard rational integral equation of nth degree	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 straight line in three dimension, Equation to straight line in symmetric form	Introduction to Sphere
	SLO-2	Fundamental theorem in the theory of equations	Sum of the powers of the roots of an equation using coefficient of power of k+1	Problems in increase - Decrease the roots of a given equation by a quantity	Equation of straight line in general form	Equation of Sphere passing through four given points
S-2	SLO-1	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 on increase and decrease the roots of an equation by a given quantity	Equation of straight line in general form	Equation of Sphere passing through four given points,
	SLO-2	Problems in polynomial equations,	Problems in sum of the powers of the roots of an equation using detached coefficient division	Diminishing the roots of an equation	Conditions for the straight line to be Parallel.	Equation of Sphere passing through end points of the diameter
S-3	SLO-1	Imaginary and irrational roots (types of solution)	Newton's theorem on the sum of the powers of the roots	Removal of terms	Equation to straight line in polar form	Equation of Sphere passing through end points of the diameter
	SLO-2	Standard rational integral equation of nth degree	Problems based on Newton's theorem	Solving the equation by removing a term.	Conditions for the straight line to be Perpendicular	Properties of Sphere
S-4	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-5	SLO-1	Theorems on imaginary and irrational roots	Find sum of the powers of the roots	Compute square of roots by Removal of terms	Condition that a line will lie on a Plane	Problems with Plane and a Sphere
	SLO-2	Finding the other roots of the equations from the given equation and its roots	Possible values of sum of powers of the roots	Problems on Removal of terms – square of the roots	Condition that a line will lie on a Plane	Problems with Plane and a Sphere
S-6	SLO-1	Solving equation having imaginary and irrational roots	Transformation of equations	Transformations in general	Intersection of line and a Plane	Condition for a plane to touch a sphere
	SLO-2	Forming the equation from the given roots	Possible ways of transforming the equation	Problems on transformations in general	Intersection of line and a Plane	Condition for a plane to touch a sphere
S-7	SLO-1	Problems on imaginary and irrational roots	Multiplication of roots by m	Transforming the equations by removal of terms	The necessary and sufficient condition that the two lines will be coplanar	Point of contact of plane and a sphere

	SLO-2	Introduction relation between roots and coefficients of equations, Solving the equations whose roots are in A.P	Form the equation whose roots are multiplied by m, Problems on forming the equation, roots of the equation in A.P	Form the new equation by Transforming the equations by removal of terms, Problems in transformations in general, Descarte's rule of signs	The necessary and sufficient condition that the two lines will be coplanar, Condition of coplanarity of two lines, one in general form and the other in symmetric form	Tangent plane of a sphere, Tangent plane of a sphere
S-8	**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-9	**SLO-1**	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 on Descarte's rule of signs	Condition of coplanarity of two lines, both in general form	Plane section of a sphere
	SLO-2	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	Condition of coplanarity of two lines, both in general form	Plane section of a sphere
S-10	**SLO-1**	Problems on relation between roots and coefficients of equations	Problems on roots with sign changed	Possible real roots - Descarte's rule of signs	Condition of coplanarity of two lines, both in symmetric form	Problems in Plane section of a sphere
	SLO-2	Solving the equations whose roots are in H.P	Roots multiplied by a given number Solving problems on Roots multiplied by a given number	Imaginary roots - Descarte's rule of signs	Condition of coplanarity of two lines, both in symmetric form	Problems in Plane section of a sphere
S-11	**SLO-1**	Symmetric functions of roots in terms of coefficients of third degree equation, Problems on symmetric functions of roots in terms of coefficients of third degree equation	Reciprocal equations, Introduction, Properties, Condition for an equation to be a reciprocal equations	Horner's method Real root – Horner's method Positive roots-Horner's method, Negative roots - Horner's method	Angle between two lines Angle between a line and a Plane	Condition for Two Spheres to touch internally and Externally Equation of sphere through the circle of intersection of two spheres,
	SLO-2	Solving cubic equations by cardano's method Solving cubic equations by comparing the product and sum Finding the roots of cubic equations by cardano's method	Solving the reciprocal equation of odd degree with like signs & unlike signs Solving the reciprocal equation of even degree	Newton's method Real root - Newton's method	Equation of two skew lines in symmetric form Shortest distance between two skew lines	Equation of sphere through the circle of intersection of plane and a sphere Angle of intersection of two spheres
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

Learning Resources	1. Advanced Engineering Mathematics by H.K. Doss, S.Chand, 2008 2. Mathematics,Volume 1, P. Kandasamy and Thilagavathy, S. Chand, New Delhi, 2004. 3. Geometry-3 Dimensional, Emerald Publishers, 1983..	4. G.S.Pandey, R.R.Sharma, Vectors and Geometry, Wishwa Prakashan.1988. 5. N.P. Bali, Solid Geometry, Laxmi Publications (P) Ltd, 2005. 6. M.L.Khanna, Solid Geometry, Jai Prakashnath & Co Publishers, Meerut, 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	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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. J. Sasikumar, SRMIST** sasikumj@srmist.edu.in

Course Code	UMA23102T	Course Name	CALCULUS	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	To learn nth derivative of product of two functions and understand the concept of partial derivatives of homogeneous functions	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 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 :	Understand the concept of double and Triple integrals																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Know the fundamental application of partial derivatives	4	85	80	*H*	-	-	-	-	*M*	*H*	-	-	-	-	*H*	-	-	-
CLO-2 :	Identify the extremum of a function with two and three variables	4	85	80	*H*	*H*	-	-	*H*	*M*	*M*	-	-	-	-	*H*	-	-	-
CLO-3 :	Understand the concept of different methods of solving integrals	4	85	80	*H*	-	-	-	*M*	*M*	*H*	-	-	-	-	*H*	-	-	-
CLO-4 :	Apply the reduction formula to evaluate given integral.	4	85	80	*H*	-	-	*H*	-	*M*	*H*	-	-	-	-	*H*	-	-	-
CLO-5 :	*Apply the concept of double and Triple integrals*	4	85	80	*H*	*H*	-	-	-	*M*	*H*	-	-	-	-	*H*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
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 Double and Triple integral

	SLO-2	Limits and Continuity	Introduction to Maxima and Minima function of two variables	Introduction to Integration	Definition of definite integral	Double integral
S-2	SLO-1	Continuity of Functions, Graphical meaning of continuity	Working rule to find Maxima and Minima	Methods of Integration	Rule to find $\int_a^b f(x)\,dx$	Double integral
	SLO-2	Differentiation of inverse functions, hyperbolic and inverse hyperbolic function	Problems in Maxima and Minima	Method of Integration-Substitution method	Properties of definite integrals	Problems in Double integral
S-3	SLO-1	Differentiation of inverse functions, hyperbolic and inverse hyperbolic function	Problems in Maxima and Minima	Method of Integration-Substitution method	Problems in properties of definite integrals	Triple integrals
	SLO-2	Problems in nth 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 Triple integrals
S-4	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-5	SLO-1	Function of logarithmic differentiation	Lagrange's method of undetermined multipliers	Method of Integration- Integration by parts	Reduction formulae $I_n=\int x^n \cos axdx$	Change of order in Double integrals
	SLO-2	Formation of equations involving derivatives	Lagrange's method of undetermined multipliers	Method of Integration- Integration by parts	Reduction formulae $I_n=\int x^n \cos axdx$	Change of order in Double integrals
S-6	SLO-1	Problems in Leibnitz formula for the nth derivative of a product	Definition of Envelope	Method of Integration- Integration by parts	Reduction formulae $I_n=\int \sin^n xdx$	Change of order in Double integrals
	SLO-2	Problems in Leibnitz formula for the nth derivative of a product	Method of finding the Envelope	Method of Integration- Successive reduction	Reduction formulae $I_n=\int \sin^n xdx$	Change of variables in Double integrals
S-7	SLO-1	Partial differentiation	Problems in Envelope	Method of Integration- Successive reduction	Reduction formulae $I_n=\int \cos^n xdx$	Change of variables in Double integrals
	SLO-2	Successive partial derivatives - problems	Problems in Envelope	Method of Integration- Successive reduction	Reduction formulae $I_n=\int \cos^n xdx$	Change of variables in Double integrals
S-8	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-9	SLO-1	Successive partial derivatives - problems	Problems in Envelope	Problems in Bernoulli's formula	Reduction formulae $I_{m,n}=\int \sin^m x\cos^n xdx$	Applications to area, volume and surface area
	SLO-2	Successive partial derivatives - problems	Problems in Envelope	Problems in Bernoulli's formula	Reduction formulae $I_{m,n}=\int \sin^m x\cos^n xdx$	Applications to area, volume and surface area
S-10	SLO-1	Function of function rule - Problems	Problems in Taylor series	Problems in Bernoulli's formula	Reduction formulae $I_n=\int \tan^n xdx$	Applications to area, volume and surface area
	SLO-2	Function of function rule Problems	Problems in Taylor series	Problems in Bernoulli's formula	Reduction formulae $I_n=\int \tan^n xdx$	Applications to area, volume and surface area
S-11	SLO-1	Function of function rule - Problems	Problems in Taylor series	Problems in Bernoulli's formula	Reduction formulae $I_n=\int \cot^n xdx$	Applications to area, volume and surface area
	SLO-2	Function of function rule - Problems	Problems in Taylor series	Problems in Bernoulli's formula	Reduction formulae $I_n=\int \cot^n xdx$	Applications to area, volume and surface area
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

Learning Resources	1. S. Narayanan and T. K. Manicavachagom Pillay, Calculus, vol-1, S. Viswanathan Printers and Publishers Pvt. Ltd., 2010. 2. , S. Narayanan and T. K. Manicavachagom Pillay, Calculus, Vol. IIS. Viswanathan Printers and Publishers Pvt. Ltd., 2010. 3. P. Kandasamy and Thilagavathy, Mathematics, vol-1, S. Chand, New Delhi, 2004.	4. Thomas and Finney, Calculus, Pearson Education, 9th Edition, 2006. 5. G. B. Thomas, R. L. Finney & M. D. Weir, Calculus and Analytic Geometry, Pearson Education Ltd, 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	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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. **.Dr. S. Vidyanandini,** **vidyanas@srmist.edu.in**

Course Code	UMA23103T	Course Name	ORDINARY DIFFERENTIAL EQUATIONS	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the motivations of first order ordinary differential equations.	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 learn the concepts of higher order ODEs by different methods.																		
CLR-3 :	To learn the methods of Simultaneous and Pfaffian differential equations.																		
CLR-4 :	To learn the concept of the Laplace transform and properties and its applications.																		
CLR-5 :	To understand the motivations of inverse Laplace transforms and its applications to solve IVP and BVP.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Justify the main motivations of the first order differential equations and understand the methods to solve.	4	85	80	H	-	-	-	-	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Learn about different solving methods of higher order differential equations.	4	85	80	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Achieve knowledge on Simultaneous and Pfaffian differential equations.	4	85	80	H	-	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Aware of Laplace transform and its motivations equations.	4	85	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Aware of inverse Laplace transform and its applications.	4	85	80	-	H	-	-	-	-	H	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Origin, classification and applications of differential equations; Order and degree of an ODE	Introduction to linear second and higher order differential equations with constant coefficients	Introduction to simultaneous differential equations of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Laplace transform: Definition, Sufficient conditions for the existence of Laplace transform	Inverse Laplace transform of derivatives and related problems
	SLO-2	Initial and Boundary value problem, definitions and examples; Formation of differential equations from real life problems	Differential operators, Complimentary functions and particular integrals with examples	Applications and geometrical interpretation of $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Examples and applications of Laplace transform	Inverse transform of Integrals and related problems
S-2	SLO-1	Existence and Uniqueness theory for first order IVP's, Lipschitz's condition, Non-existence of solution for a first order IVP	Methods to find out particular integrals of the form e^{ax}, $sin\ sin\ ax$ and $cos\ cos\ ax$	Rules (Rule-I and Rule-II) for solving the simultaneous differential equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Linear and shifting property of Laplace transform	Residue theorem on Inverse Laplace transform
	SLO-2	Orthogonal and oblique trajectories with examples	Methods to find out particular integrals of the form $x^n, e^{ax}\ f(x)$	Problems on solving the simultaneous differential equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Problems and examples on linear and shifting property	Problems related to Residue theorem

S-3	**SLO-1**	ODE of first order and first degree: Variable separations, Homogenous functions	Methods to find out particular integrals of the form $x^n \ sin \ sin \ ax$ $or \ x^n \ cos \ cos \ ax$	Rules (Rule-III and Rule-IV) for solving the simultaneous differential equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Laplace transform of derivatives and change of scale property	Convolution theorem and properties of convolution
	SLO-2	Linear differential equations, Integrating factor, Bernoulli's form	Methods to find out particular integrals of the form $x\ f(x)$	Problems on solving the simultaneous differential equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$	Problems based on Laplace transform of derivatives	Problems based on Convolution theorem
S-4	**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-5	**SLO-1**	Exact differential equations, necessary and sufficient criterion, examples	The method of Undetermined Coefficients	Introduction of Pfaffian differential equation of the form $Pdx+Qdy+Rdz=0$	Laplace transform periodic functions	Solutions of ODE's with constant coefficients using Laplace transform
	SLO-2	Problems on exact differential equations	Problems on the method of Undetermined Coefficients	Necessary and sufficient conditions for integrability of a single differential equation of the form $Pdx+Qdy+Rdz=0$	Problems based on Laplace transform of periodic functions	Problems related to solution of ODE's with constant coefficients
S-6	**SLO-1**	Differential equations reducible to exact form using integrating factors	The method of Variation of Parameters	Condition of exactness of the Pfaffian differential equation $Pdx+Q$ dy + R dz=0	Laplace transform of of unit step functions and translated functions	Solutions of ODE's with variable coefficients using Laplace transform
	SLO-2	Problems on differential equations reducible to exact form	Problems on the method of Variation of Parameters	Method I of solving the Pfaffian differential equation $Pdx+Qdy+Rdz=0$ (solution by inspaction)	Laplace transform of Unit step functions and translated functions	Problems related to solution of ODE's with variable coefficients
S-7	**SLO-1**	First order ODE's with higher degree: Equations solvable for y	Cauchy-Euler Equations	Method II of solving the Pfaffian differential equation $Pdx+Qdy+Rdz=0$ (solution of homogeneous equation)	Laplace transform of integrals	Solutions of simultaneous ODE's using Laplace transform
	SLO-2	Problems on solvable for y	Problems on Cauchy-Euler Equations	Problems on solving $Pdx+Qdy+Rdz=0$	Problems based on Laplace transform of integrals	Problems on simultaneous ODE's
S-8	**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-9	**SLO-1**	Equations solvable for x	Existence and Uniqueness of higher order homogeneous linear IVP	Method III of solving the Pfaffian differential equation $Pdx+Qdy+Rdz=0$ (use of auxiliary equation) and related problems	Laplace transform of some special functions, the error function	Application of Laplace transform for solving Integral equations
	SLO-2	Problems on solvable for x	Linearly independent solutions, Wronskian and their relations	Problems on solving $Pdx+Qdy+Rdz=0$	Problems based on error function	Problems on solving Integral equations using Laplace transform
S-10	**SLO-1**	Equations solvable for p	Ordinary and Singular point of a second-order homogeneous linear differential equation	General method of solving the Pfaffian differential equation $Pdx+Qdy+Rdz=0$ by taking one variable as constant	Inverse Laplace transform, Uniqueness of inverse transform and examples	Initial and boundary value problems, Solution of boundary value problems involving partial differential equations using Laplace transform
	SLO-2	Problems on solvable for p	Regular and Irregular singular points and examples	Problems on solving $Pdx+Qdy+Rdz=0$	Linearity property and problems on Inverse Laplace transform	Problems related to boundary value problems using Laplace transform

S-11	SLO-1	Clairaut's form	Power series solution about an ordinary point	Geometrical interpretation of $Pdx + Qdy + Rdz = 0$ and related examples	Inverse Laplace transform using partial fractions, Heaviside's expansion theorem and related problems	Solution of one-dimensional wave equation using Laplace transform
	SLO-2	Problems on Clairaut's form	Power series solution about a regular singular point (Frobenius method)	To show $Pdx + Qdy + Rdz = 0$ is orthogonal to the locus of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ and related examples	First and second shifting theorem on inverse Laplace transform and related problems	Solution of one-dimensional heat equation using Laplace transform
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

Learning Resources	1. Shepley L. Ross, Differential Equations, Third Edition, Wiley Student Edition. 2. George F. Simmons and Steven G. Krantz, Differential Equations – Theory, Technique, and Practice, TATA McGraw-Hill. 3. M. D. Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd.	4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley & Sons 5. .C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 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	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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr Abhishek Banerjee,** abhisheb@srmist.edu.in

Course Code	UCD23S01L	Course Name	Quantitative Aptitude and Logical Reasoning	Course Category	S	Skill Enhancement Course	L	T	P	0	C
							0	0	2	2	1

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Demonstrate various principles involved in solving mathematical concepts			
CLR-2 :	Critically evaluate basic mathematical concepts related to profit, loss, interest calculations, average and interpret data			
CLR-3 :	Enable students to understand reasoning skills			
CLR-4 :	Use the basic mechanics of Grammar			
CLR-5 :	Acquire time management skills and expose students to the requirements of the job market			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the concepts of LCM, HCF, ratio and proportions, percentages and approach questions in a simpler and innovative method	3	80	70
CLO-2 :	Develop, solve, analyze, and use simple mathematical models that are relevant to daily life.	3	80	75
CLO-3 :	Solve problems on reasoning	3	85	70
CLO-4 :	Understand the different parts of speech and use them in sentences appropriately	3	85	80
CLO-5 :	Instill confidence in students and develop skills necessary to face the audience	3	85	75

		Program Learning Outcomes (PLO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		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 Behaviour	Life Long Learning
CLO-1 :		H	M	-	M	-	M	-	H	M	H	-	M	-	-	-
CLO-2 :		H	M	-	M	L	M	-	H	M	H	-	M	-	-	-
CLO-3 :		-	M	-	-	-	M	M	H	-	H	-	H	-	-	-
CLO-4 :		H	-	-	-	-	-	M	M	-	-	-	H	H	-	M
CLO-5 :		-	-	M	-	-	M	-	-	M	-	H	M	-	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Speed Maths and Simplification	Profit and Loss-Introduction	Number Series	Most Logical Choice	Self-Introduction - Introduction
	SLO-2	Simplification Techniques and Tricks	Profit and Loss- Basic Problems	Number Series – Solving Problems	Most Logical Choice – solving problems	Self-Introduction - Session 1
S-2	SLO-1	Divisibility	Simple Interest-Introduction, Formulas &Problems	Word Series	Logical Order	Self-Introduction - Session 2
	SLO-2	Power cycle, Reminder cycle	Compound Interest-Introduction, Formulas &Problems	Word Series – Solving Problems	Logical Order – tips and tricks	Self-Introduction - Session 3
S-3	SLO-1	Problems On H.C.F and L.C.M	Averages-Introduction& Basics	Odd man out	Synonyms	Self-Introduction - Session 4
	SLO-2	Problems On H.C.F and L.C.M Solving problems	Averages-Tricky Problems	Missing number and wrong number	Antonyms	Self-Introduction - Session 5
S-4	SLO-1	Linear and Simultaneous Equation	Algebra –Introduction	Image Based Problems- Introduction	Essential Part	Self-Introduction - Session 6

	SLO-2	Linear and Simultaneous Equation – solving problems	Algebraic Expressions Concepts	Image Based Solving Problems	Parts of Speech - Worksheets	Self-Introduction - Session 7
S-5	**SLO-1**	Ratio and Proportions-Introduction	Data Interpretation – Bar chart, Pie Chart	Inequalities	Spotting Error	Basics of Written Communication
	SLO-2	Ratio and Proportions-Basics Problems	Data Interpretation – Table, Line Graph	Inequalities - methods	Spotting Error –Concord, Prepositional usage, Usage of Articles	Basics of Written Communication Methods
S-6	**SLO-1**	Percentage -Introduction	Quadratic Equations	Coding – Decoding-Introduction	Sentence Correction – Vocabulary based	Time Management Skills
	SLO-2	Percentage- Basic problems	Quadratic Equations – Formulas and Methods	Coding – Decoding-Different types	Sentence Correction – Grammar Based	Time Management Skills - Activity

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, Place Mentor: 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. Singh O.P., Art of Effective Communication in Group Discussion and Interview, S Chand & Company, 2014* *6. Bhatnagar R P, English for Competitive Examinations, Trinity Press, 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	30%	30%	30%	10%
	Understand				
Level 2	Apply	30%	30%	30%	50%
	Analyze				
Level 3	Evaluate	40%	40%	40%	40%
	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, Extempore, 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
Mr. M. Ponmurugan, Executive PMOSS, Cognizant Technology Solutions India Pvt. Limited, Chennai	*Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeedam, Coimbatore*	*Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST*
		Ms. Deepalakshmi S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST

Course Code	UCD23V01T	Course Name	Universal Human Values	Course Category	V	Value Addition Course	L	T	P	0	C
							2	0	0	2	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Help the students to understand need of value education, appreciate the essential complimentarily between 'values' and 'skills' and to ensure sustained happiness and prosperity which are the core aspirations of all human beings,	1
CLR-2 :	Help students initiate a process of dialog within themselves to know what they really want to be' in their life and profession.	2
CLR-3 :	Help students to understand the meaning of happiness and prosperity for a human being. understanding holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.	3
CLR-4 :	Help students on right understanding of the Human reality and the rest of existence, harmony at all the levels of human living, and live accordingly.	
CLR-5 :	Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	3	80	70
CLO-2 :	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	3	80	75
CLO-3 :	Analyze the value of harmonious relationship based on trust and respect in their life and profession	3	85	70
CLO-4 :	Examine the role of a human being in ensuring harmony in society and nature.	3	85	80
CLO-5 :	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	3	85	75

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	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 :	M	-	-	H	-	-	-	-	-	-	M	-	-	H	H
CLO-2 :	-	M	-	H	-	L	-	-	-	-	-	-	-	H	H
CLO-3 :	-	-	-	H	-	-	-	M	L	-	-	-	-	H	H
CLO-4 :	-	-	-	H	-	-	L	-	L	L	-	L	M	H	H
CLO-5 :			L	H	L	-	-	-	-	-	-	-	M	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO	Right Understanding, Relationship and Physical Facility	Understanding Human being as the Co-existence of the Self and the Body	Harmony in the Family – the Basic Unit of Human Interaction	Understanding Harmony in the Nature	Natural Acceptance of Human Values
S-2	SLO	Understanding Value Education	Distinguishing between the Needs of the Self and the Body	Trust – the Foundational Value in Relationship	Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature	Definitiveness of (Ethical) Human Conduct

S-3	***SLO***	*Self-exploration as the Process for Value Education*	*The Body as an Instrument of the Self*	*Respect – as the Right Evaluation*	*Exploring the Four Orders of Nature*	*A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order*
S-4	***SLO***	*Continuous Happiness and Prosperity – the Basic Human Aspirations*	*Understanding Harmony in the Self*	*Other Feelings, Justice in Human-to-Human Relationship*	*Realizing Existence as Co-existence at All Levels*	*Competence in Professional Ethics*
S-5	***SLO***	*Happiness and Prosperity – Current Scenario*	*Harmony of the Self with the Body*	*Understanding Harmony in the Society*	*The Holistic Perception of Harmony in Existence*	*Holistic Technologies, Production Systems and Management Models-Typical Case Studies*
S-6	***SLO***	*Method to Fulfill the Basic Human Aspirations*	*Programme to ensure self-regulation and Health*	*Vision for the Universal Human Order*	*Exploring Co-existence in Existence*	*Strategies for Transition towards Value-based Life and Profession*

Learning Resources	1. *Gaur R.R., Sangal R., Bagaria G.P., 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi.* 2. *E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.*	3. *A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.* 4. *A N Tripathy, 2003, Human Values, New Age International Publishers.*

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	30%	30%	30%	30%
	Understand				
Level 2	Apply	40%	40%	40%	40%
	Analyze				
Level 3	Evaluate	30%	30%	30%	30%
	Create				
	Total	100 %	**100%**	**100%**	**100%**

CLA-1, CLA-2 and CLA-3 can be from any combination of these: MCQ Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Extempore, etc.

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

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
-	-	*Dr. Supraja P, UHV University Coordinator, SRMIST*
		Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST
		Dr. Sweety Bakyarani E, Department of Computer Science, FSH, SRMIST

SEMESTER II

Course Code	ULT23G02J	Course Name	Tamil – II	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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:*
CLR-1 :	*சங்க இலக்கியங்கள் வழி தொன்மை அக, புற வாழ்வியலை அறியச் செய்தல்*
CLR-2 :	*தமிழ்ச்சமூகத்தின் அறவியல் குறித்து தெரியச் செய்தல்*
CLR-3 :	*பக்தி இலக்கியங்கள் போதித்த மனித மாண்புகளை உணரச் செய்தல்*
CLR-4 :	*பண்டைத் தமிழ்ச்சமூகத்தின் தொல் இலக்கியங்கள் வளர்ச்சி பெற்ற வரலாற்றைப் புரியச் செய்தல்*
CLR-5 :	*சிறுகதைகள் சொல்லும் வாழ்வியல் நெறி, மொழியின் நுட்பங்கள் ஆகியவற்றைத் தெரியச் செய்தல்*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*பண்டைத் தமிழ்ச் சமூகத்தின் அக, புற வாழ்வியல் இன்றைய சமூக மேம்பாட்டிற்கு வழிகாட்டி நிற்பதை அறிந்துகொள்ளுதல்*	2	75	60	H	L	H	M	H	H	L	M	H	M	L	H	-	-	-
CLO-2 :	*தமிழ்ச் சமூகம் அறத்தை வலியுறுத்திய சமூகம் என்பதன் வழி மானுட அறத்தைத் தெரிந்துகொள்ளுதல்*	2	80	70	H	M	H	L	M	H	L	H	M	L	H	H	-	-	-
CLO-3 :	*பக்தி இலக்கியம் மூலம் இறைத் தந்துவங்களை அறிந்து மானுட ஒற்றுமை மேம்பாட்டை அறிந்துகொள்ளுதல்*	2	70	65	H	L	H	M	H	H	M	H	L	H	M	H	-	-	-
CLO-4 :	*தொல் தமிழ்ச்சமூகம் இலக்கியம், அரசியல், அறம், பக்தி ஆகியவற்றில் தழைத்தோங்கியதைத் தெரிந்துகொள்ளுதல்*	2	70	70	H	M	H	L	H	M	M	H	H	L	H	H	-	-	-
CLO-5 :	*வாழ்வியலின் நெறிகளைச் சொல்லும் கதைகளைப் படைக்கும் திறனோடு மொழி ஆளுமையையும் அறிந்துகொள்ளுதல்*	2	80	70	H	M	H	H	M	H	L	M	H	L	H	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*காலந்தோறும் தமிழ் அகத்திணை மரபு*	*சங்க மருவிய காலம்*	*பல்லவர் காலம்*	*பண்டைக்காலத் தமிழகம்*	*தமிழ்ச் சிறுகதைப் போக்குகள்*

	SLO-2	அக இலக்கியத்தின் கட்டமைப்பு/ உள்ளடக்கம்	அறமும் வாழ்வியலும்	பல்லவர் கால இலக்கியங்கள்	சங்ககால மக்களின் வாழ்வியல்	தமிழ்ச் சிறுகதையும் தமிழ்ச் சமூக வாழ்வியலும்
S-2	SLO-1	எட்டுத்தொகை நூல்களும் பகுப்புமுறையும்	உலகப்பொதுமறை - திருக்குறள்	பக்தியும் தமிழும்	முச்சங்கம் – அறிமுகம்	புதுமைப்பித்தன் - சங்குத்தேவனின் தர்மம்
	SLO-2	ஐங்குறுநூறு (375)	திருக்குறளின் கட்டமைப்பு	பக்தி இலக்கியத் தோற்ற நிலை	முச்சங்க வரலாறு	கள்வனின் தர்மம்
S-3	SLO-1	உடன்போக்கும் நற்றாய் புலம்பலும்	திருக்குறள் வான்சிறப்பு (2)	சைவ சமய இலக்கியங்கள்	பத்துப்பாட்டும் எட்டுத் தொகையும்	ந.பிச்சமூர்த்தி – வேப்பமரம்
	SLO-2	ஐங்குறுநூறு (391)	மழையும் வாழ்வும்	சைவக்குரவர் நால்வர்	சங்க கால மக்களின் வாழ்வியல்	மரபும் நம்பிக்கைகளும்
S-4	SLO-1	உடன் போக்கும் தமிழர் பறவையியல் அறிவும்	திருக்குறள் – புலவி நுணுக்கம்	தேவாரம் – திருஞான சம்பந்தர் - பாடல் – 2834	எட்டுத்தொகை நூல்களின் வரலாறு	தமிழருவி மணியன் – ஒற்றைச் சிறகு
	SLO-2	குறுந்தொகை (02)	ஊடலின் அழகியல்	தேவாரம் – திருநாவுக்கரசர் –பாடல் - 4262	எட்டுத்தொகை நூல்களின் கட்டமைப்பு	உறவின் மேன்மை
S-5	SLO-1	இயற்கைப் புணர்ச்சியும் தலைவி நலம் பாராட்டலும்	நீதி இலக்கியங்கள்	திருவாசகம் அறிமுகம்	பத்துப்பாட்டு நூல்களின் வரலாறு	ஆர். சூடாமணி – மூடநம்பிக்கை
	SLO-2	குறுந்தொகை (03)	நாலடியார்	மாணிக்கவாசகர் பாடல் - ஆனந்த பரவசம் – பாடல் 10	பத்துப்பாட்டும் தமிழர் வாழ்வியலும்	சமூகத்தில் மூடநம்பிக்கைகள்
S-6	SLO-1	தலைவனின் மேன்மைத் தன்மையும் இயற்கையும்	வைகலும் - பாடல் (39)	வைணவ சமயம்	பதினெண் கீழ்க்கணக்கு நூல்கள்	மூடநம்பிக்கைகளின் சிக்கல்கள்
	SLO-2	அகநானூறு (238)	நிலையாமையும் அறமும்	வைணவ சமய வளர்ச்சிப்போக்கு	பதினெண் கீழ்க்கணக்கும் தமிழர் அற மரபும்	கிருஷ்ணா டாவின்ஸி – காலா அருகே வாடா
S-7	SLO-1	இயற்கையும் அகவாழ்வுச் சித்திரிப்பும்	தமிழர் மருத்துவம்	நாலாயிரத் திவ்யப் பிரபந்தம்	நீதி இலக்கியங்கள்	மனித வாழ்வில் மருத்துவம்
	SLO-2	நள்ளியின் கொடைத்திறம்	நீதி இலக்கியத்தில் மருந்து நூல்கள்	குலசேகராழ்வார் பாடல் - 678	நீதி இலக்கியங்களின் பன்முகத் தன்மைகள்	பாரம்பரிய மருத்துவம்
S-8	SLO-1	கலித்தொகைப் பாடல் – (11)	சிறுபஞ்சமூலம் (64)	ஆண்டாள் பாடல் – 574.	காப்பிய இலக்கணம்	மொழிப்பயிற்சி
	SLO-2	அறம் பொருள் இன்பம் சிறப்பு	ஈகையின் சிறப்பு	திருமழிசை ஆழ்வார் பாடல் – கணிகண்ணன்	காப்பியத்தின் போக்குகள்	சொற்களை உருவாக்குதல்

S-9	SLO-1	சூழலியலும் மனித வாழ்வும்	பழமொழி நானூறு அறிமுகம்	தமிழில் இஸ்லாமிய இலக்கியங்கள்	காப்பியங்களின் வகைமை	எழுத்துகளில் இருந்து சொற்களைக் கண்டுபிடித்தல்
	SLO-2	தமிழர் புறமரபு	பழமொழி நானூறு – தனித்தன்மைகள்	இஸ்லாமிய இலக்கியங்களின் கொடை	ஐம்பெருங்காப்பியங் களின் தனித்தன்மைகள்	படம் பார்த்துக் கதை எழுதுதல்
S-10	SLO-1	புறநானூறு (107) பாரியும் மாரியும்	பழமொழி நானூறு (184)	சீறாப்புராணத்தின் அமைப்பு	தமிழ்ச் சமூகமும் சமயத் தத்துவங்களும்	படம் பார்த்துக் கவிதை எழுதுதல்
	SLO-2	புறநானூறு (110) பாரியின் வள்ளல் தன்மை	பழமொழியும் அறிவுரையும்	விடமீட்டப் படலம் (10 பாடல்கள்)	சமயத் தத்துவங்களும் வாழ்வியல் விழுமியங்களும்	கற்பனைத்திறன் – வளர்த்தல்
S-11	SLO-1	புறநானூறு (112) கையறுநிலை	பண்டைக்காலப் போரும் வாழ்வும்	கிறித்தவ சமய இலக்கியங்கள்	சைவத் திருமுறை – அறிமுகம்	கற்பனையும் படைப்பும்
	SLO-2	சிறுபாணாற்றுப்படை (84-115)	புற இலக்கியங்கள்	கிறித்தவ இலக்கியங்களின் தமிழ்க் கொடை	பன்னிரு திருமுறை – வரலாறு	தமிழில் வாசகம்
S-12	SLO-1	கடையெழு வள்ளல்களின் சிறப்புகள்	களவழி நாற்பது (40)	கிறித்துவின் அருள்வேட்டல் – திரு.வி.க	நாலாயிரத் திவ்வியப் பிரபந்தம் – அறிமுகம்	விளம்பரத்திற்கு வாசகம் எழுதுதல்
	SLO-2	பட்டினப்பாலை (40-50) அட்டில் சாலைகளின் நிலை	போர்க்களமும் யானைப்படையும்	அலகிலொளி – 5 பாடல்கள்	வைணவ ஆழ்வார்கள் வரலாறு	வாசகம் எழுது முறைகள்

earning Resources	1. கொன்றை, தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள், தமிழ்த்துறை, எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம், காட்டாங்குளத்தூர், 603203, 2023 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%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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**
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		2. Dr. R. Ravi, Assistant Professor and Head, Dept. of Tamil, FSH, SRMIST, VDP.
		3. Mr. G. Ganesh, Assistant Professor, Dept. of Tamil, FSH, SRMIST, RMP.
		4. Dr. T.R.Hebzibah beulah Suganthi, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.
		5. Dr. S.Saraswathy, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.

Course Code	ULH23G02J	Course Name	HINDI-II	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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:*
CLR-1 :	*They get to learn Ancient ,Medieval,and Modern poetry*
CLR-2 :	*To understand the Significance of poems of great poets like Kabir,Tulsidas,Bihari and Dhananand*
CLR-3 :	*To Enhance and Enrich their knoeledge through poetry*
CLR-4 :	*Media based understanding for employability*
CLR-5 :	*Job Oriented writing skills*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*To provide a brief Introduction of Hindi poetry(Bhaktikal,Reetikal and Aadhunikkal)*	*2*	*75*	*80*	*H*	*H*	*H*	*M*	*L*	*H*	*L*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-2 :	*To Discuss the origin and development of various forms of poetry in Hindi*	*2*	*80*	*90*	*H*	*H*	*H*	*M*	*L*	*H*	*H*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-3 :	*Focus on Evaluating the social changes through poetry*	*2*	*75*	*95*	*H*	*H*	*M*	*L*	*H*	*H*	*M*	*H*	*M*	*M*	*H*	*H*	-	-	-
CLO-4 :	*To Examine Transcreation in advertisement*	*2*	*80*	*90*	*H*	*H*	*L*	*H*	*M*	*H*	*L*	*H*	*H*	*M*	*H*	*H*	-	-	-
CLO-5 :	*To guide the students in the learning of the technical aspect of the Hindi Languge,this would help them in the field administration*	*2*	*85*	*90*	*M*	*H*	*M*	*H*	*L*	*H*	*H*	*L*	*H*	*M*	*H*	*H*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	*BHAKTI* KALIN KAVITA	RITI *KALIN* KAVITA	*ADHUNIK KAVITA*	*VIGYAPAN*	PATRA *LEKHAN & PARIBHASHIK* SHABDAVALI
	SLO-2	*BHAKTIU KALIN KAITA KI AVADHARNA*	*AVADHARNA*	*AVADHARNA*	*AWADHARNA*	*VADHARNA*
S-2	SLO-1	*SWARUP*	*SWARUP*	*SWARUP*	*ARTH*	*RTH*
	SLO-2	*MAHATVA*	*RITI KAL VIBHAJAN*	*MAHATVA*	*PARIBHASHA*	*WARUP*
S-3	SLO-1	*UDDESHYA*	*MAHATVA*	*DDESHYA*	*SWARUP*	*ARIBHASHA*
	SLO-2	*BHAKTIKAL KI PRASANGIKTA*	*UDDESHYA*	*MATHLI SHARAN GUPT- NAR HO NA NIRASH KARO MAN KO*	*VIGYAPAN KE PRAKAR*	*RAYOJAN*
S-4	SLO-1	*DOHE- KABIRDAS*	*DOHE- BIHARI*	*KAVI PARICHAYA*	*VIGYAPAN KI VISHESHTAYEN*	*RAYOG*
	SLO-2	*SANT PARICHAY*	*KAVI PARICHAYA*	*KAVITA KA VISLESHAN*	*VIGYAPAN MANG*	*AHATVA*
S-5	SLO-1	*DOHE KA VISLESHAN*	*DOHE KA VISLESHAN*	*ASHAVADI DRISHTIKON*	*VIGYAPAN KA PRABHAV*	*ATRALEKHAN KALA*
	SLO-2	*GURU KA MAHATVA*	*KANAK KA MAHATVA*	*SANGHARSH KI AOR PRERNA*	*VIGYAPAN MAHATVA*	*RAKAR*

S-6	SLO-1	*GURUTVA SE ISHVARATVA KI AOR*	*VIPRIT SWABHAV KI CHARCHA*	*SURYAKANT TRIPATHI NIRALA- VAR DE*	*VIGYAPAN KI BHASHA*	*VYAKTIGAT PATRA*
	SLO-2	*GURUTVA SE ISHVARATVA KI AOR*	*PRAKRITI KA ATAL RUP*	*KAVI PARICHAYA*	*VIGYAPAN AUR BAZAR*	*AUPCHARIK PATRA*
S-7	SLO-1	*BAHYA ADAMBAR KA VIRODH*	*YAMAK ALANKAR KA PRAYOG*	*KAVITA KA VISLESHAN*	*VIGYAPAN AUR ROZGAR*	*SARKARI PATRA*
	SLO-2	*MURTI POOJA KA VIRODH*	*SNEH KE MAHATVA KI CHARCHA*	*SARSHWATI KE PATRI SAMARPAN*	*PRINT VIGYAPAN*	*ARDHA SARKARI PATRA*
S-8	SLO-1	*GHARELU VASHTUON KI UPYOGITA*	*BIHARI KI KAVYA SHAILI KA MAHATVA*	*BHAKTI KI BHAVANA*	*ELECTRONIC VIGYAPAN*	*PARIBHASHIK SHABDAVALI*
	SLO-2	*AHNKAR KA PARITYAG*	*DOHE- GHANANAND*	*NAGARJUN-- AKAL AUR USKE BAD*	*VIGYAPAN PARIYOJANA*	*AVADHARNA*
S-9	SLO-1	*DOHE- TULSHIDAS*	*KAVI PARICHAYA*	*AKAL KA VASHTAVIK CHITRAN*	*VIGYAPAN AUR SAMAJ*	*SHABDAVALI KI AVSHYAKTA*
	SLO-2	*PAROPKAR KI BHAVANA*	*DOHE KA VISLESHAN*	*AKAL KE PURVA KA CHITRAN*	*VIGYAPAN KI VYAPAKTA*	*KARYALYIN SHABDAVALI*
S-10	SLO-1	*DAYA KA MAHATVA*	*SNEH KI SARLTA KA VARNAN*	*AKAL KE BAD KA CHITRAN*	*VIGYAPANLEKHAN KALA*	*EK DIN EK SHABD*
	SLO-2	*ISHVAR KI MHATTA*	*PREM KA MAHATVA*	*KATTIS- BADRINARAYAN*	*VIGYAPAN AUR JAGRUPTA*	*HINDI SE ANGREJI SHABD*
S-11	SLO-1	*MADHUR VAHAN KI UPYOGITA*	*NAYIKA KE PRATI SMARPAN*	*SAMBAND VICCHED KI PARICHARCHA*	*UDDESHYA*	*ANGREJ SE HINDI SHABD*
	SLO-2	*RAM KI MAHIMA*	*GHANANAND KI KAVYA SHAILI KA MAHATVA*	*SWARTH NIHIT BHAVANA*	*VIGYAPAN KI SPASTTA*	*ABHYASH KARYA*
S-12	SLO-1	*DHOHA PARICHARCHA*	*DHOHA PARICHARCHA*	*KAVYA PARICHARCHA*	*VIGYAPANPARICHARCHA*	*PARICHARCHA*
	SLO-2	*PRASHNAABHYASH*	*PRASHNAABHYASH*	*PRASHNAABHYASH*	*PRASHNAABHYASH*	*PRASHNAABHYASH*

Learning Resources	***Edited Book: ""SAMANYA HINDI", SRIJONLOK PUBLICATION, 2023, New Delhi.*** 1. KABIR – HAZARI PRASAD DWEDI 2. SURDAS – RAM CHANDRA SHUKL 3. BHAKTI ANDOLAN AUR SURDAS KA KAVYA – MANAGER PANDEY 4. BIHARI – VISHVNATH PRASAD MISHR 5. Aadhunik Vigyapan aur Jansampark – Taresh Bhatia

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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	30%	30%	30%	30%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
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		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3.Dr. S. Razia Begum, Assistant Professor, SRM IST
		4, Dr.Nisha Murlidharan Assistant Professor, VDP,SRM IST

Course Code	ULF23G02J	Course Name	French-II	Course Category	G	Generic Elective Course	L	T	P	O	C
							2	0	2	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:*
CLR-1 :	Strengthen the language of the students both in oral and written
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

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*To acquire knowledge about French language*	*2*	*75*	*80*	*H*	*M*	*H*	*H*	*M*	*H*	*H*	*L*	*M*	*M*	*H*	*L*	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*90*	*M*	*H*	*L*	*H*	*H*	*M*	*H*	*M*	*L*	*L*	*H*	*M*	-	-	-
CLO-3 :	*To develop content using the features in French language*	*2*	*75*	*80*	*H*	*H*	*L*	*M*	*H*	*M*	*L*	*H*	*M*	*M*	*H*	*H*	-	-	-
CLO-4 :	*To interpret the French language into other language*	*2*	*75*	*90*	*H*	*L*	*M*	*H*	*M*	*H*	*H*	*M*	*L*	*H*	*M*	*L*	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*75*	*M*	*H*	*H*	*L*	*M*	*M*	*H*	*H*	*M*	*L*	*H*	*M*	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	**Temps libre**	Le pronom indéfini *on*	**Vendre**	Il faut	Les gallicismes
	SLO-2	Les activités quotidiennes	Les activités	Les exemples	C'est / Il est	Les activités
S-2	SLO-1	Les exemples	Les adjectifs interrogatifs	**Acheter**	Le verbe devoir	Les pronoms personnels COI
	SLO-2	Les activités	Les activités	Les exemples	Les activités	Les exemples
S-3	SLO-1	Les moments de la journée	Les prépositions avec les noms géographiques	Les aliments	Le verbe pouvoir	Le pronom *y*
	SLO-2	Les exemples	Les activités	Les exemples	Le verbe savoir	Les exemples
S-4	SLO-1	Les matières scolaires	Les verbes prendre et sortir	Les emballages	Le verbe vouloir	Des pronoms compléments
	SLO-2	Les exemples	Les activités	Les exemples	Les sons	Les activités
S-5	SLO-1	Les activités	Les sons	Les quantités	Demander et dire le prix	Les nombres ordinaux
	SLO-2	Les loisirs	Les activités	Les exemples	Les activités	Les exemples
S-6	SLO-1	Les exemples	Parler de ses gouts	Les commerces	Faire des achats	Les verbes écrire et voir
	SLO-2	Les activités	Les activités	Les activités	Expliquer une recette de cuisine	Les activités
S-7	SLO-1	La fréquence	Parler de ses préférences	les commerçants	Les activités	Le E caduc ou instable
	SLO-2	Les exemples	Les activités	Les exemples	Les courses	Les exemples

S-8	**SLO-1**	Les activités	Parler de sa routine	L'impératif	Les activités	Présenter ses vœux
	SLO-2	Les verbes pronominaux	Les activités	Les activités	Vendre et acheter	Présenter ses souhaits
S-9	**SLO-1**	Les exemples	A la recherche d'un cadeau –.	Les articles partitifs	Mots et expressions	Présenter ses félicitations
	SLO-2	Les activités	Les activités	Les exemples	Grammaire	inviter à une invitation
S-10	**SLO-1**	Les pronoms personnels COD	Temps libre	*Très* ou *beaucoup* (de)	Communication	répondre à une invitation
	SLO-2	Les exemples	Les activités	Les exemples	**Tout le monde s'amuse**	Les exemples
S-11	**SLO-1**	Les activités	Mots et expressions	Le pronom en (la quantité)	Les sorties	Écrire un message amical
	SLO-2	Les adjectifs démonstratifs	Les activités	Les exemples	Les saisons	Les exemples
S-12	**SLO-1**	Les exemples	Grammaire –Communication	La phrase négative (2	Les fêtes	Parler au téléphone
	SLO-2	Les activités	Les activités	Les exemples	Les messages	Un coup de fil

Learning Resources	***Theory:*** ***1.*** " **Nouvelle 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.*** ***3.*** *https://www.fluentu.com/blog/french/french-grammar* ***4.*** *https://www.elearningfrench.com/learn-french-grammar-online-free.html* ***5.*** *https://www.lawlessfrench.com/grammar* ***6.*** *https://blog.gymglish.com/2022/12/15/basic-french-grammar*

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 (5%)#**			
		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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. Mr. Kavaskar Danasegarane Process Expert Maersk Global Service Center Pvt. Ltd	*1. Dr. C.Thirumurugan Professor, Department of French, Pondicherry University*	*1. Mr. Kumaravel K. Assistant Professor & Head, SRMIST, KTR*
2.Mr. Sharath Raam Prasad Character Designer, Animaker Company Pvt.		*2. Mrs. Abigail, Assistant Professor, SRMIST, VDP*

Course Code	UES23AE1T	Course Name	ENVIRONMENTAL STUDIES	Course Category	AE	Ability Enhancement Courses	L	T	P	O	C
							3	0	0	2	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:*
CLR-1 :	*To create awareness on Environment and Renewable and Non-renewable resources*
CLR-2 :	*To understand about ecosystem and Biodiversity*
CLR-3 :	*To understand the natural and anthropogenic impact of the environmental pollution*
CLR-4 :	*To create awareness on different environmental problems*
CLR-5 :	*To create awareness on various Environment Protection acts and the impact of human population on environment*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)	PLO 1 Fundamental Knowledge	PLO 2 Application of Concepts	PLO 3 Link with Related Disciplines	PLO 4 Procedural Knowledge	PLO 5 Skills in Specialization	PLO 6 Ability to Utilize Knowledge	PLO 7 Skills in Modeling	PLO 8 Analyze, Interpret Data	PLO 9 Investigative Skills	PLO 10 Problem Solving Skills	PLO 11 Communication Skills	PLO 12 Analytical Skills	PLO 13 ICT Skills	PLO 14 Professional Behavior	PLO 15 Life Long Learning
CLO-1 :	*Applying knowledge on Renewable and Non-renewable resources*	*2*	*80*	*65*	*L*	*H*	*L*	*M*	*L*	*H*	*L*	*L*	*L*	*H*	*L*	*M*	-	-	*M*
CLO-2 :	*Understanding about ecosystem and Biodiversity*	*2*	*80*	*70*	*M*	*H*	*L*	*M*	*L*	*H*	*L*	*L*	*L*	*H*	*L*	*M*	-	-	*M*
CLO-3 :	*Gathering knowledge on impact of environmental pollution*	*2*	*80*	*70*	*L*	*H*	*L*	*M*	*L*	*H*	*M*	*M*	*M*	*H*	*L*	*M*	-	-	*M*
CLO-4 :	*Understanding of different environmental problems*	*2*	*80*	*70*	*M*	*H*	*L*	*M*	*L*	*H*	*M*	*M*	*M*	*H*	*L*	*M*	-	-	*M*
CLO-5 :	*Having knowledge on various Environment Protection acts and the impact of human population on environment problems*	*2*	*80*	*65*	*M*	*H*	*L*	*M*	*L*	*H*	*L*	*M*	*L*	*H*	*L*	*M*	-	-	*M*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Multidisciplinary nature of environmental studies*	*Energy flow in the ecosystem*	*Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity*	*Disaster management- Nature*	*Environment Protection Act*
	SLO-2	*Definition, Scope and Importance of Environmental Studies*	*Energy flow in the ecosystem*	*Environmental Pollution- Definition*	*Floods, Earthquakes*	*Air (Prevention and Control of Pollution) Act*
S-2	SLO-1	*Need for public awareness.*	*Ecological succession*	*Causes, Effects and Control Measures of Air Pollution*	*Cyclones*	*Water (Prevention and control of Pollution) Act*
	SLO-2	*Institutions in Environment*	*Food chains, Food webs and Ecological pyramids*		*Landslides*	*Wildlife Protection Act*

S-3	**SLO-1**	*People in Environment*	*Ecosystem, Introduction, Types, Characteristic features, Structure and functions*	*Causes, Effects and Control Measures of Water Pollution*	*Social Issues and the Environment:* *From Unsustainable to Sustainable Development*	*Forest Conservation Act*
	SLO-2	*Introduction to natural resources-Associated Problems*	*Forest ecosystem*			*Issues involved in enforcement of environmental legislation*
S-4	**SLO-1**	*Renewable and Nonrenewable resources*	*Grassland ecosystem*	*Causes, Effects and Control Measures of Soil Pollution*	*Urban problems related to energy*	*Public awareness*
	SLO-2	*Forest resources*	*Desert ecosystem*		*Water Conservation*	
S-5	**SLO-1**	*Water Resources*	*Aquatic ecosystems (ponds, lakes, streams)*	*Causes, Effects and Control Measures of Marine pollution*	*Rain Water Harvesting,* *Watershed*	*Human Population and the Environment: Population growth, variation among nations*
	SLO-2	*Mineral Resources*	*Aquatic ecosystems (rivers, estuaries, oceans)*			
S-6	**SLO-1**	*Food Resources*	*Biodiversity and its conservation-genetic, species and ecosystem diversity*	*Causes, Effects and Control Measures of Noise Pollution*	*Environmental Ethics: Issues and Possible Solutions*	*Population explosion – Family Welfare Programme*
	SLO-2	*Energy Resources*	*Biogeographical classification of India*			*Environment and human health*
S-7	**SLO-1**	*Land Resources*	*Value of Biodiversity*	*Causes, Effects and Control Measures of Thermal Pollution*	*Climate change & Global warming*	*Human Rights*
	SLO-2	*Role of an individual in conservation of natural resources*	*Biodiversity at Global, National and Local Levels*			*Value Education*
S-8	**SLO-1**	*Equitable use of resoureces for sustainable lifestyles*	*India as a Mega Diversity Nation*	*Causes, Effects and Control Measures of Nuclear hazards*	*Acid rain & Ozone layer depletion*	*HIV/AIDS*
	SLO-2	*Concept of an ecosystem*	*Hot-spots of biodiversity*			
S-9	**SLO-1**	*Structure and Functions of an ecosystem*	*Threats to biodiversity: habitat loss, poaching of wildlife man-wildlife conflicts*	*Solid Waste Management* *Causes, Effects and Control Measures of Urban and Industrial Waste*	*Nuclear Accidents and Nuclear Holocaust*	*Women and Child Welfare*
	SLO-2	*Producers, consumers and decomposers*	*Endangered and endemic species of India*	*Role of Individuals In Pollution Prevention*	*Wasteland Reclamation*	*Role of Information Technology in Environment and human health*

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. 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
Dr.Arumugam Perumal, Director ARMATS BIOTEK Training and Research Institute, Chennai	Dr.N.Banu, Assistant Professor Bharathi Womens College (Autonomous), Chennai	*1. Dr. P. Parthipan, Assistant Professor, Department of Biotechnology, FSH, SRMIST*
		2.Dr. D. Sankari, Professor and Head, Department of Biotechnology, FSH, SRMIST

Course Code	UMA23104T	Course Name	Probability and Probability Distributions	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the concepts of probability.	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 learn the concepts of two dimensional random variables.																			
CLR-3 :	To learn the concepts of Probability mass function (p.m.f), Probability Density Function (p.d.f).																			
CLR-4 :	To learn the concepts of Moment Generating Function.																			
CLR-5 :	To understand the known distribution.																			
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																			
CLO-1 :	Solve problem On Probability	4	85	80		*H*	*M*	*M*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	-	-	-
CLO-2 :	Get exposed to the random variable.	4	85	80		*H*	*H*	*H*	*M*	*H*	*M*	*H*	*M*	*M*	*M*	*M*	*M*	-	-	-
CLO-3 :	Be familiar with Probability mass function (p.m.f), Probability Density Function (p.d.f).	4	85	80		*H*	*H*	*M*	*M*	*M*	*L*	*M*	*M*	*M*	*L*	*M*	*M*	-	-	-
CLO-4 :	Solve problem On Moment Generating Function.	4	85	80		*H*	*M*	*M*	*H*	*M*	*M*	*L*	*M*	*L*	*L*	*M*	*M*	-	-	-
CLO-5 :	Solve problem on various known distribution.	4	85	80		*H*	*H*	*H*	*H*	*M*	*M*	*H*	*M*	*M*	*L*	*L*	*M*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to Probability	Random Variable, discrete and continuous random Variable	Introduction to Mathematical Expectation and generating functions.	Introduction to Poisson distribution	Application of Negetive Binomial distribution
	SLO-2	Random experiments, Sample Space, events and algebra of events	Probability mass function (p.m.f), Probability Density Function (p.d.f)	Expectation of Single and bivariate random variable.	MGF, mean, variance of Poisson distribution	Problems on Binomial distribution
S-2	SLO-1	Classical, satistical and axiomatic definition of probability	Cumulative distribution function (c.d.f.)	Problem based on expectation of Single and bivariate random variable.	Applications of Poisson distribution	Introduction to exponetial distribution
	SLO-2	Introduction to random experiments, sample space, events and algebra of events	Illustration and and properties of random variable and c.d.f.	Introduction to Moments and Cumulants	Problems on Poisson distribution	MGF, mean, variance of Exponential distribution

S-3	SLO-1	Conditional probability and multiplication theorem	Problem based on p.m.f, p.d.f and on c.d.f	Moment Generating Function, cumulants generating function	Introduction to Geometric distribution	Applications of Exponential distribution
	SLO-2	Problem based on conditional probability and multiplication theorem	Problem based on p.m.f, p.d.f and on c.d.f. Introduction to two dimension random variables	Characteristic function	MGF, mean, variance of Geometric distribution	Problems on Exponential distribution
S-4	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-5	SLO-1	Laws of addition and multiplication, independent events	Two dimension random variables, joint, marginal and conditional p.m.f., p.d.f., c.d.f.	Problems on Moment Generating Function	Applications of Geometric distribution	Introduction to Cauchy distribution
	SLO-2	Applications on independent events	Problem based on p.m.f, p.d.f and on c.d.f for two dimension random variable.	Problems on Cumulants Generating Function and Characteristic function	Problems on Geometric distribution	MGF, mean, variance of Cauchy distribution
S-6	SLO-1	Topological Spaces.	Closure and interior of a set	Properties of connected spaces	Properties of compact spaces	Countability axioms
	SLO-2	Examples.	Properties based on closure and interior	Applications of connected spaces	Applications of compact spaces	Countability axioms
S-7	SLO-1	Bernoulli's Trials	Applications of Two dimensional discrete random variables	Application of Uniqueness and inversion theorems	Applications of Uniform distribution	Introduction to Gamma and Beta distribution
	SLO-2	De Moivre-Laplace Approximation	Problems in Two dimensional discrete random variables	Application of Uniqueness and inversion theorems	Problems on Uniform distribution	MGF, mean, variance of Gamma and beta distribution
S-8	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-9	SLO-1	Problem based on Bernoulli's Trials and De Moivre-Laplace Approximation	Applications of Two dimensional continuous random variables	Conditional expectation	Introduction to Normal distribution	Applications of Gamma and Beta distribution
	SLO-2	Problem based on Bernoulli's Trials and De Moivre-Laplace Approximation	Problems in Two dimensional continuous random variables	Problem based on Conditional expectation	MGF, mean, variance of Normal distribution	Applications of Gamma and Beta distribution
S-10	SLO-1	Generalisation Bernoulli's Theorem Multinomial Distribution (G.B.M)	Applications on Independent random variables	Introduction to Binomial distribution	Applications of Normal distribution	Properties of Gamma and Beta and limiting/ approximation cases
	SLO-2	Problem based on G.B.M	Problems on Independent random variables	MGF, mean and variance of Binomial distribution	Problems on Normal distribution	Properties of Gamma and Beta and limiting/ approximation cases
S-11	SLO-1	Basic Introduction to expectation and variance	Expectation and variance for two dimensional random variable	Applications of Binomial distribution	Introduction to negetive Binomial distribution	Problems on Gamma distribution
	SLO-2	Problem based expectation and variance	Problems based on Expectation and variance for two dimensional random variable	Problems on Binomial distribution	MGF, mean and variance of Negetive Binomial distribution	Problems on Beta distribution
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

Learning Resources	1.. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi. 2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia. 3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi	4.T. Veerarajan, Probability, Statistics and Random process, Tata Major Core Graw Hill, 1st reprint, 2004. 5. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.

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. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. Provanjan Mallick, **provanjm@srmist.edu.in**

Course Code	UMA23105T	Course Name	Multivariate Calculus	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	*Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion*	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 :	*Understand the maximization and minimization of multivariable functions subject to the given constraints on variables*																		
CLR-3 :	*Understand the vectors study of integration of functions of several variables*																		
CLR-4 :	*Study about inter-relationship amongst the line integral, double and triple integral formulations*																		
CLR-5 :	*Familiarize with Green's, Stokes' and Gauss divergence theorems*																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	*Able to use differential calculus ideas on several variable functions*	4	85	80	*H*	*H*	*H*	*M*	*H*	-	-	-	-	-	-	M	-	-	-
CLO-2 :	*Able to use multi variable calculus tools in physics, economics, optimization problems*	4	85	80	*H*	*H*	*H*	*M*	*M*	-	-	-	-	-	-	*H*	-	-	-
CLO-3 :	*Able to apply different methods of integration in solving practical problems*	4	85	80	*H*	*M*	*H*	*H*	*M*	-	-	-	-	-	-	*M*	-	-	-
CLO-4 :	*Able to apply multiple integral ideas in solving areas, volumes and other practical problems*	4	85	80	*H*	*H*	*M*	*H*	*M-*	-	-	-	-	-	-	*M*	-	-	-
CLO-5 :	*Able to understand the inter relation between line integral, surface integral and volume integral*	4	85	80	*M*	*H*	*H*	*M*	*H*	-	-	-	-	-	-	*M*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Functions of several variables	Taylor's expansion of functions of several variables	Vector field	Double integration over rectangular and nonrectangular regions	Line integrals
	SLO-2	Limits and continuity	Taylor's expansion of functions of several variables	Vector field	Double integration over rectangular and nonrectangular regions	Line integrals
S-2	SLO-1	Partial differentiation	Extrema of functions of two variables	Scalar field	Double integration in polar coordinates	Applications of line integrals: Mass and work
	SLO-2	Higher order partial derivative	Extrema of functions of two variables	Level curves and surfaces	Double integration in polar coordinates	Applications of line integrals: Mass and work

S-3	**SLO-1**	Tangent planes	Local maxima	Curl	Triple integral over a parallelopiped and solid regions	Fundamental theorem for line integrals
	SLO-2	Higher order partial derivative	Local maxima	Gradient	Triple integral over a parallelopiped and solid regions	Fundamental theorem for line integrals
S-4	**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-5	**SLO-1**	Total differential and differentiability	Local minima	Divergence	Volume by triple integral	Conservative vector fields
	SLO-2	Total differential and differentiability	Local minima	Divergence	Volume by triple integral	Conservative vector fields
S-6	**SLO-1**	Chain rule	Lagrange's method of undetermined multipliers	Change of variables	Triple integration in cylindrical and spherical coordinates	Conservative vector fields
	SLO-2	Chain rule	Lagrange's method of undetermined multipliers	Change of variables	Triple integration in cylindrical and spherical coordinates	Green's theorem
S-7	**SLO-1**	Implicit functions	Constrained optimization problems	Directional derivatives	Triple integration in cylindrical and spherical coordinates	Green's theorem
	SLO-2	Jacobians	Constrained optimization problems	Directional derivatives	Triple integration in cylindrical and spherical coordinates	Area as a line integral
S-8	**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-9	**SLO-1**	Euler's theorem on homogeneous functions	Maximal and normal property of the gradient	Line integrals for scalar functions	Change of variables in double and triple integrals	Stokes' theorem
	SLO-2	Euler's theorem on homogeneous functions	Maximal and normal property of the gradient	Line integrals for scalar functions	Change of variables in double and triple integrals	Stokes' theorem
S-10	**SLO-1**	Euler's theorem on homogeneous functions	Maximal and normal property of the gradient	Line integrals for scalar functions	Change of variables in double and triple integrals	Gauss divergence theorem
	SLO-2	Euler's theorem on homogeneous functions	Maximal and normal property of the gradient	Line integrals for scalar functions	Change of variables in double and triple integrals	Gauss divergence theorem
S-11	**SLO-1**	Harmonic functions	Tangent planes	Line integrals for scalar functions	Change of variables in double and triple integrals	Gauss divergence theorem
	SLO-2	Harmonic functions	Tangent planes	Line integrals for scalar functions	Change of variables in double and triple integrals	Gauss divergence theorem
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

Learning Resources	1. M. J,.Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley, Pvt. Ltd. (Pearson Education), Delhi, 2007 2. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus,*Springer(SIE). Indian reprint, 2005. 3. James Stewart, *Multivariable Calculus, Concepts and Contexts,*2nd Ed., Brooks/*Cole,* Thomson Learning, USA, 2001.	4. S. C. Mallik and S. Arora: Mathematical Analysis, New Age International Publications. 5. S. Ghorpade, B. V. Limaye, Multivariable calculus, Springer international edition. 6. H. Anton, I. Bivens and S. Davis, Calculus, Wiley, 10th Edition, 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**
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Course Code	UMA23106T	Course Name	PARTIAL DIFFERENTIAL EQUATIONS	Course Category	C	Discipline Specific Core	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the motivation and elementary methods to solve PDEs
CLR-2 :	To learn the method of characteristic, i.e., the solution of such PDE is constant along characteristic
CLR-3 :	Various solution techniques of heat-diffusion equation (Finite, Semi-finite, infinite) with different methods accordingly and the heat flow
CLR-4 :	To understand how wave propagate
CLR-5 :	To learn the main important two integral transform which helps to transform the PDEs into ODEs

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 :	Justify the main motivation about PDEs	4	85	80	H	H	L	M	H	M	H	M	M	L	L	H	-	-	-
CLO-2 :	Find out the interesting facts about method of characteristic	4	85	80	M	H	M	M	M	L	L	L	M	L	M	H	-	-	-
CLO-3 :	Explain the significance of the classification of PDEs like elliptic, parabolic and hyperbolic	4	85	80	H	H	H	H	H	H	H	H	M	H	M	H	-	-	-
CLO-4 :	Analyze consequences of two integral transforms like Fourier and Laplace Transform	4	85	80	H	H	H	M	H	H	M	H	M	L	M	H	-	-	-
CLO-5 :	Learn about the important fact about separation of variables in finite domain for wave, heat and Laplace equation.	4	85	80	H	H	L	M	H	M	H	M	M	L	L	H	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Motivation: Heat Equation formulation	Introduction to Clauirt's Equations	Solution of infinite-diffusion equation using Fourier transform	Classification of PDEs (Hyperbolic)	Heat Equation Cartesian and derivation of polar coordinates
	SLO-2	Motivation: Heat Equation formulation	Solution of Clauirt's Equations	Solution of infinite-diffusion equation using Fourier transform	One dimensional Wave Equation and D-Alembert's solution	Heat Equation Cartesian and derivation of polar coordinates
S-2	SLO-1	Motivation: Wave Equation (Vibrating String and Membranes) formulation	General form of second order PDEs, Examples	Introduction to Laplace transform (LT)	D-Alembert's solution of wave equations for homogeneous Wave Equation in infinite domain	Solution of heat equation in polar form

	SLO-2	Motivation: Wave Equation (Vibrating String and Membranes) Formulation	Classification of PDEs	Properties of LT including derivative, integration, convolution and polynomial multiplication	Some examples	Solution of heat equation in polar form
S-3	SLO-1	Definition, Order and Degree, General form, Examples	Classification of PDEs (Parabolic)	Properties of LT including derivative, integration, convolution and polynomial multiplication	D-Alembert's solution of wave equations for homogeneous WE in infinite domain	Fundamental solution
	SLO-2	Properties of Linear, Semi-Linear, Quasi-linear and Fully Nonlinear with examples	Heat Equation / Diffusion Equation	Laplace transform of some elementary functions	D-Alembert's solution of wave equations for homogeneous WE in infinite domain	Fundamental solution
S-4	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-5	SLO-1	First order PDE, Solutions using Lagrange Methods	Method of separation of variables	Dirac Delta function and its representation	Domain of dependence of wave equation	Solution in polar coordinates
	SLO-2	Geometrical Interpretation of 1st order linear PDE	Method of separation of variables for homogeneous finite-diffusion problems	LT of Dirac delta distribution	Domain of dependence of wave equation	Solution in polar coordinates
S-6	SLO-1	Method of Characteristics for Linear PDE	Sine and Cosine transform	FT of Dirac delta distribution	Graphically Illustration of domain of dependence	Poisson Summation Formula
	SLO-2	Method of Characteristics for Linear PDE	Properties of Sine and Cosine transform	Some application of Dirac delta distribution	Region of Influence of solution of wave equation	Poisson Summation Formula
S-7	SLO-1	Physical Interpretation	Solution of infinite-diffusion problems using sine transform	Complex Inversion Formula (Mellin-Fourier Integral)	Region of Influence of solution of wave equation	Introduction to BVP of Third kind (Mixed of first kind and second kind)
	SLO-2	Physical Interpretation	Transform of Error Function	Complex Inversion Formula (Mellin-Fourier Integral)	Graphically Illustration of Region of Influence	Solution of Laplace equations using separation of variables
S-8	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-9	SLO-1	Method of Characteristic for Semi Linear PDE	Introduction to Fourier transform methods	Solution of infinite-diffusion equation using LT	Finite Vibrating string problems	Infinite differentiable functions
	SLO-2	Method of Characteristic for Quasi Linear (Burger equation)	Properties of Fourier transform and inversion	Solution of infinite-diffusion equation using LT	Solution of wave equation in finite domain using separation of variables	Taylors theorem and radius of convergence
S-10	SLO-1	Charpit method for fully non-linear PDE	Convolution	Solution of non-homogeneous heat equation	Formulation of Laplace equation	Analytic Function (Definition) and example
	SLO-2	Charpit method	Fourier transform of convolution	Solution of non-homogeneous heat equation	Classification of PDEs (Elliptic)	The Cauchy Problem and Cauchy Kovalevsky Theorem
S-11	SLO-1	Integral curves and vector field	FT of Gaussian is Gaussian	Duhamel's Principle	Introduction to BVP of first kind (Interior Dirichlet and exterior Dirichlet problems)	The Cauchy Problem and Cauchy Kovalevsky Theorem
	SLO-2	Integral curves and vector field	Simple proof using the properties of FT and making ODE	Duhamel's Principle / Method of variation of parameter	Introduction to BVP of second kind (Neumann problems)	The Cauchy Problem and Cauchy Kovalevsky Theorem
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

Learning Resources	1. Stanley J. Farlow, Partial Differential Equations for Scientists and Engineerings, Dover Publications, 1993. 2. L. C. Evans, Partial Differential Equations, American Mathematical Society, 2010. 3. I. N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1998.	4. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 5. A.K. Nandhakumar, P.S. Datti, Partial differential equations, IISC press, 2020.

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. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. Swaraj Paul, SRMIST swarajp@srmist.edu.in

Course Code	UCD23S02T	Course Name	Verbal Ability and Skill Development	Course Category	S	Skill Enhancement Course	L	T	P	O	C
							2	0	0	2	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Critically evaluate basic mathematical concepts related to mixtures and alligations, Numbers, time and work
CLR-2 :	Use their logical thinking and analytical abilities to solve reasoning problems
CLR-3 :	Develop soft skills relating to the need for job recruitment
CLR-4 :	Provide students with the necessary skills to generate and interpret data sufficiency, problems on Chain Rule, Pipes and Cisterns, Boats and streams,
CLR-5 :	Enable students to understand problems on graphs and also increase their ability in language skills

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 Behaviour	Life Long Learning
CLO-1 :	Understand the concepts of mixtures and alligations, Numbers, time and work and to approach questions in a simpler and innovative method	3	80	70	M	H	-	L	-	M	-	M	M	H	-	H	-	-	-
CLO-2 :	Establish a student's interest and awareness in seating arrangements, mathematical operations, logical reasoning	3	80	75	M	H	-	L	-	M	-	M	M	H	-	H	-	-	-
CLO-3 :	Acquire soft skills that will help for applying jobs	3	85	70	-	-	M	H	M	-	L	-	-	-	H	-	M	M	H
CLO-4 :	Demonstrate various principles involved in aptitude problems	3	85	80	-	-	-	-	M	-	L	H	-	H	-	H	-	-	L
CLO-5 :	Ability to solve problems on reasoning and to interpret English language	3	85	75	-	H	-	L	-	H	-	M	M	-	H	--	M	-	M

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Time and Distance – Introduction	Seating Arrangements (Circular and table) Introduction	Resume Building - Introduction	Chain Rule, Pipes and Cistern – Introduction	Functions and Graphs Introduction
	SLO-2	Time and Distance – Problems	Seating Arrangements (Circular and table) – Problems	Resume Building	Chain Rule, Pipes and Cistern – Problems	Functions and Graphs – Problems
S-2	SLO-1	Time & Work- Introduction	Mathematical Operations – Basic Problems	Group Discussions - Introduction	Data Sufficiency – Introduction	Comprehension
	SLO-2	Time & Work – Problems	Mathematical Operations – Tricky Problems	Group Discussions – Mock GD	Data Sufficiency – Problems	Comprehension – Practise session
S-3	SLO-1	Alligation or Mixture – Introduction	Data Arrangements - Introduction	Group Discussions - Activity 1	Logarithms – Introduction	Idioms and Idiomatic Expressions – Introduction
	SLO-2	Alligation or Mixture - Problems	Data Arrangements – Problems	Group Discussions - Activity 1	Logarithms – Problems	Idioms and Idiomatic Expressions – Practise Session
S-4	SLO-1	Numbers – Basic Problems	Logical Deductions – Introduction	Group Discussions - Activity 2	Boats and Streams – Basic Problems	Cause and Effect - Introduction

	SLO-2	Numbers – Tricky Problems	Logical Deductions – Problems	Group Discussions - Activity 2	Boats and Streams – Tricky Problems	Cause and Effect – Practise Session
S-5	**SLO-1**	Problems on Trains – Introduction	Letter and Symbol Series – Basic Problems	Leadership Skills Introduction	True Discount – Introduction	Theme detection – Introduction
	SLO-2	Problems on Trains – Problems	Letter and Symbol Series – Tricky Problems	Leadership Skills	True Discount – Problems	Theme detection – Activity
S-6	**SLO-1**	Races and Games – Basic Problems	Input Output Tracing Introduction	How to Handle Criticism and Feedback	Geometry and Mensuration Introduction	Ordering of words _ Introduction
	SLO-2	Races and Games – Tricky Problems	Input Output Tracing – Problems	How to Handle Criticism and Feedback	Geometry and Mensuration – **Problems**	Ordering of words – Practise Session

Learning Resources	1. James Barrett & Tom Barrett - Ultimate aptitude tests: over 1000 practice questions for abstract visual, numerical, verbal, physical, spatial and systems tests, Kogan Page, London, 2018. Fourth edition 2. Kathy A. Zahler & Over Drive, Inc (Distributor) Conquering GRE verbal reasoning and analytical writing, McGraw-Hill Education, New York, 2020 Second Edition 3. Archana Ram, Place Mentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018	4. David Bartlett, The art of general practice: soft skills to survive and thrive, Scion, Banbury, 2018, eBook, 2018 **5.Zsolt Nagy, Soft skills to advance your developer career: actionable steps to help maximize your potential, A press, Berkeley, CA, 2019, eBook, 2022**

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	30%	20%	30%	30%
	Understand				
Level 2	Apply	30%	50%	30%	30%
	Analyze				
Level 3	Evaluate	40%	30%	40%	40%
	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
Mr. M. Ponmurugan, Executive PMOSS, Cognizant Technology Solutions India Pvt. Limited, Chennai	*Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeedam, Coimbatore*	*Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST* *Dr. Muthu Deepa M, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST*

Course Code	UEN23V01L	Course Name	COMMUNICATION SKILLS	Course Category	AE	Value Addition Course	L	T	P	O	C
							0	0	4	2	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Department of English, FSH, SRMIST	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 Discipline	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 :	Develop fluency in spoken English by practicing and engaging in various speaking activities.																		
CLR-2 :	Improve pronunciation and intonation to enhance clarity and effectiveness in oral communication.																		
CLR-3 :	Expand vocabulary and idiomatic expressions to communicate more accurately and expressively.																		
CLR-4 :	Enhance listening skills to understand and respond appropriately to spoken English in different situations.																		
CLR-5 :	Employ effective communication strategies, such as active listening, summarizing, paraphrasing, and asking clarifying questions, to enhance interpersonal and intercultural communication.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Demonstrate improved fluency in spoken English by expressing ideas and thoughts confidently and coherently.	2	75	60	H	M	M	L	-	M	-	M	H	L	H	L	-	-	-
CLO-2 :	Pronounce English words and phrases accurately, using appropriate intonation and stress patterns.	2	80	70	M	H	L	-	-	-	-	M	M	H	H	M	-	-	-
CLO-3 :	Expand and effectively use a range of vocabulary and idiomatic expressions to enhance communication.	2	70	65	M	M	M	-	L	L	-	H	M	H	H	L	-	-	-
CLO-4 :	Understand and comprehend spoken English in various contexts, including informal conversations, lectures, and presentations.	2	70	70	H	M	L	-	M	H	-	-	-	-	H	L	-	-	-
CLO-5 :	Deliver well-structured and engaging oral presentations, incorporating effective body language and visual aids.	2	80	70	H	H	-	M	-	M	-	L	L	M	H	M	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to Listening Skills.	Introduction to Reading Skills. Discussion of techniques of Reading Skill	Introduction to Speaking Skills. Explaining the importance of phonetics and vocabulary	Introduction to Writing Skills Importance of writing skills	Introduction to appreciation of texts.
	SLO- 2	Exploring Effective Ways of Listening. Barriers of Listening. Active and Passive Listening.	Identifying common reading problems in students after making them read a few passages.	Explaining the usage of the Oxford Learner's Dictionary to learn phonetics of the words at the fundamental level.	Explaining various forms of writing with examples:.	Encouraging the students to share a few of their favourite lines from any sources they have read or sharing a few lines from paditthadhil piditthadhu.
S-2	SLO-1	Introduction to Digital language lab/ usage of mobile applications	Learners are enabled to record their speech and listen to it in order to correct their problematic areas	The right enunciation of certain words to be taught through phonetic representation and decoding the phonetic symbols by learning to use the dictionary..	Introduction to letter writing. Types of letters- Formal and Informal letters with examples. Learning E-mail etiquette.	Explaining why appreciating texts creates a good reader.
	SLO- 2	Equipping the listening skill of the learners	repetitive practices of reading select paragraphs from web resources, their standard will be measured.	Observe and repeat and learn the phonetic pronunciation of words by practicing continuously.	Class Assignment - write a formal letter and informal letter and check for e-mail etiquettes in writing.	Enabling the students to reflect in the classroom about any of their favourite books/ articles or magazines.

S-3 – S-4	SLO-1	*Introducing google podcasts.*	*The speed, fluency, pronunciation, comprehension of the words in the paragraph*	*Teaching the usage of Thesaurus to understand and develop various words and improve vocabulary.*	*Enabling the students to unleash their potentials in creative writing through writing transcripts for advertisements of any product.*	*Introducing the text of Letters by Mathrubootham published in the Hindu.*
	SLO- 2	*Task to write down the words from the audio they have listened to. This activity should be done in two steps. 1. Jotting down the words simultaneously as they listen to the speaker. 2. Writing the transcript of the audio through repetitive play and pause.*	*hints and tricks to follow where the pauses are to be followed.*	*Identifying common errors in concord, preposition, direct speech and indirect speech.*	*write a review of any book or a movie or an interview or a debate.*	*Reading and recitation of the text of the first letter-Enjoy within limits, says Mr. Mathrubootham* *Understanding characters by analyzing the usage of their style of language*
S-5	SLO-1	*Imitating the speakers by listening to them and attempting to learn the pronunciation of the words uttered in the audio.*	*Students group 1- reads – group 2 identifies the flaws in reading.*	*Identifying common errors in tenses, punctuation, and syntactical errors..*	*Mechanics of writing like capitalization, punctuation, spelling, correct pronoun, preposition, concord usage can be taught.*	*Reading of the second letter- Nobel? What Nobel, asks Mr. Mathrubootham.*
	SLO- 2	*Repetitive listening to enhance pronunciation skills*	*The roles have to be exchanged between the two groups and the activity should be practiced.*	*Rectifying the common errors and instructing the learners about the right usage in order to avoid common errors.*	*meachnaics of writing - assessed and evaluated.*	*Mathrubootham's humour and the language of code switching from Tamil to English and vice –versa.*
S-6	SLO-1	*Introducing to the audios of TED TALK American Speakers. Listening to the native speakers of English Language through TED TALKS.*	*Identify the key arguments in a passage - introductory point, lead point, supportive argument statement, concluding point and the common connecting word between all the key words in the passage.*	*Practicing how to avoid common errors.*	*Teaching effective writing by learning to avoid common errors in concord, preposition, conjunction, relative pronouns, question tags.*	*Reading of the third letter -Mr. Mathrubootham is fully supporting all new technologies*
	SLO- 2	*Introducing to the audios of TED TALK British Speakers. Listening to the native speakers of English Language through TED TALKS.*	*encouraged to identify the key arguments in other passages on their own.*	*The learners are introduced to collocations for quick choice of learning how to speak in short time and how to speak effectively.*	*Practicing effective writing by learning to avoid common errors in concord, preposition, conjunction, relative pronouns, question tags.*	*Mathrubootham's frustration over the failure of technologies and the language that he positively uses to denote hopelessness over technologies.*
S-7 – S-8	SLO-1	*American and British styles can be differentiated.*	*Guiding the act of reading through scanning and skimming by model reading of the passages by the instructor.*	*Practice collocations*	*common errors in tenses, direct and indirect speech and syntax structure.*	*Reading of the fourth letter in the classroom and discussion* *Pizza maavu: Welcome to Mr. Mathrubootham food recipe website,*
	SLO- 2	*The recognition of different accents should be practiced by speaking after listening.*	*scanning and skimming activities*	*Idioms and phrases*	*Practicing effective writing by learning to avoid common errors in tenses, direct and indirect speech and syntax structure.*	*Mathrubootham's love for food and the miscommunication about food.*
S-9	SLO-1	*Learning advanced pronunciation and vocabulary through various computer applications like Woodpecker.*	*Loud reading and slow mind reading*	*A speaking task to learn- collocations, idioms and phrases, vocabulary and phonetic pronunciation*	*Teaching how to write statement of purpose for admission to higher educations, and practicing the same.*	*Analyisng the text for regional relevance and National significance.*
	SLO- 2	*imitate the different sounds and accents - repeat it after listening to any of the videos from the library based on individual interest.*	*Pauses, pronunciation, comprehension and fluency can be checked for improvement at this stage through repetitive practices.*	*Their speaking activity is to be recorded and played again to rectify the errors and highlight the problematic areas in speaking.*	*Teaching how to write a story by looking at a picture.* *Developing the writing skill through word ladders.*	*Appreciating the aesthetics of the comic element and the embodiment of humour in the narrative in the letter*
S-10	SLO-1	*Repeat listening to the same time frames and move from 02.01 to 03.00*	*Students -groups -checking the comprehension skills. Analyse the text of a passage.*	*Automating vocabulary through engaging the students in various activity games like solving crossword puzzle and playing scattergories.*	*Introduction to blog writing and steps to become an effective blog writer.*	*importance of bringing in the Indianized way of speaking the English Language in order to depict*

						the character called Mathrubootham.
	SLO- 2	*Choosing any particular time frame and practicing it.*	*Brainstorming the comprehension skills- questioning the key points in the passage.*	*Engaging the students to play the games in order to learn the vocabulary.*	*Encourage the readers to create their own blogs and post articles on a regular basis.*	*relatable characters of both formal and informal everyday life experiences.*
S 11 - S 12	**SLO-1**	Interested students can complete listening and reflecting the complete audio listening practice and speaking.	*Cross check with misunderstanding if any and rectify- match the question and answers.*	*Spur of the moment speech.:*	*Selecting any news article and learning the writing style in it.*	*Talk about their favourite letter from the letters of Mathrubootham by recollecting the appreciation of the text according to their perception and understanding.*
	SLO- 2	*Group activities and games can be conducted to test the listening skills by responding to the speech given by other students*	*Passages for reading comprehension are to be given for practice that tests their reading skills.*	*Prepared speech :* *Giving a speaking task to the students to speak on their own choice*	*Students are given chances to write reports on various topics.*	*Enabling the students to share their appreciation of any of their favourite lines form the books they have read.*

Learning Resources	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%) #**
		Practice	Practice	Practice	Practice
Level 1	Remember Understand	10%	10%	30%	15%
Level 2	Apply Analyze	50%	50%	40%	50%
Level 3	Evaluate Create	40%	40%	30%	35%
	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**
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Course Code	UNS23M01L / UNC23M01L / UNO23M01L / UYG23M01L	Course Name	NSS/NCC/NSO/YOGA	Course Category	M	Mandatory	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

SEMESTER III

Course Code	UMA23107T	Course Name	Number Theory	Course Category	C	*Discipline Specific Core Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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:
CLR-1 :	Introduce divisibility conditions in detail and the prime numbers
CLR-2 :	Employ congruences
CLR-3 :	understand concepts of Number-Theoretic Functions
CLR-4 :	Introduce the primitive roots and indices
CLR-5 :	Introduce the concept of quadratic residues and cryptography
CLR:6	Introduce divisibility conditions in detail and the prime numbers

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	PSO -1	PSO -2	PSO-3
CLO-1 :	Gain an insight on elementary number theory concepts	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Be familiar with prime numbers and congruence	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understanding Euler function and applications	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Analyse thoroughly the primitive roots	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Gain an insight of cryptography	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	The principle of induction	Introduction to Congruences	number of divisors	order of a modulo n	Legendre symbol
	SLO-2	The well ordering principle	Definition	sum of divisors	Related theorems	properties
S-2	SLO-1	Divisibility	properties of Congruences	prime factorization	order of an integer	Primes of 4k+1
	SLO-2	Properties of Divisibility	proof	Related theorems	Related theorems	quadratic residues
S-3	SLO-1	Greatest Common Divisor	Binary and decimal representations of integers	multiplicative functions	Lagrange's theorem	properties
	SLO-2	Properties of GCD	Related theorems	τ and σ multiplicative functions	proof	Gauss's lemma
S-4	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-5	SLO-1	Linear combination	linear congruence	Mobius μ-function	primitive roots	Primes of 8k-1
	SLO-2	GCD as linear combination	Solution of linear congruence	Related theorems	Primitive Roots for Primes	proof
S-6	SLO-1	Linear combination	relatively prime	The Chinese Remainder theorem	Mobius inversion formula	Composite Numbers Having Primitive Roots

	SLO-2	GCD as linear combination	relatively prime integers in terms of linear combinations	proof	proof	Related theorems
S-7	SLO-1	relatively prime	Euclid's lemma	Sun-Tsu problem	greatest integer function	Theory of indices
	SLO-2	relatively prime integers in terms of linear combinations	proof	solution	Related theorems	A contour integral representation for the Hurwitz zeta function
S-8	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-9	SLO-1	Euclidean Algorithm	system of linear congruences	Euler's Phi-Function	illustrative examples	Introduction to Cryptography
	SLO-2	proof	solution	prime-power factorization	illustrative examples	plaintext
S-10	SLO-1	Diophantine Equation	Fermat's Little theorem	φ is multiplicative function	quadratic residue	ciphertext
	SLO-2		proof	Properties of φ	Euler's Criterion	Knapsack Cryptosystem
S-11	SLO-1	Fundamental Theorem of Arithmetic	Wilson's theorem	Euler's theorem	Proof of Euler's Criterion	knapsack problem
	SLO-2	proof	Fermat-kraitchik factorization method	proof	Related problems	Primitive Roots to Cryptography
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

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. 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
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Course Code	ULT23AE1J	Course Name	Applied Tamil – I	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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:*

CLR-1 :	தமிழின் எழுத்து, சொல் வளர்ச்சி வரலாற்றை அறியச் செய்தல்
CLR-2 :	மொழியைப் பிழையின்றி எழுதும் ஆற்றலை அடையச் செய்தல்
CLR-3 :	வாய்மொழி வழக்காறுகளின் நுட்பங்களைத் தெரியச் செய்தல்
CLR-4 :	கடிதம் எழுதும் முறை, கட்டுரை வரையும் முறை அறியச் செய்தல்
CLR-5 :	படைப்பாற்றல் திறனை வளரச் செய்தல்

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	PLO 1 Fundamental Knowledge	2 Application of Concepts	3 Link with Related	4 Procedural Knowledge	5 Skills in Specialization	6 Ability to Utilize	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 :	சொற்களைச் சரியான பொருண்மையில் பயன்படுத்தும் திறன் பெறுதல்	2	75	60	H	L	H	M	H	H	L	M	H	M	L	H	-	-	-
CLO-2 :	மொழியைப் பிழையின்றி எழுதுவதன் வழி மொழி ஆளுமை பெறுதல்	2	80	70	H	M	H	L	M	H	L	H	M	L	H	H	-	-	-
CLO-3 :	வாய்மொழி மரபின் கூறுகள் வழி, மக்களின் வாழ்வியல் விழுமியங்களை அறிந்துகொள்ளுதல்	2	70	65	H	L	H	M	H	H	M	H	L	H	M	H	-	-	-
CLO-4 :	அலுவலகப் பயன்பாடு, திறன் மேம்பாடு ஆகியவற்றை நுட்பமாகத் தெரிந்துகொள்ளுதல்	2	70	70	H	M	H	L	H	M	M	H	H	L	H	H	-	-	-
CLO-5 :	கவிதை, கதை படைக்கும் ஆற்றலை அறிந்துகொள்ளுதல்	2	80	70	H	M	H	H	M	H	L	M	H	L	H	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	தமிழின் தொன்மை	மெய்யெழுத்துகளின் வகைகள்	வாய்மொழி மரபு, எழுத்து மரபு	தொடர் அமைப்பு	காலந்தோறும் கவிதை
	SLO-2	தமிழின் சிறப்புகள்	மூவினம்	வாய்மொழி மரபில் அனுபவம்	எளிய தொடர்	கவிதை வடிவம்
S-2	SLO-1	கருத்து – பரிமாற்றம்	ஒற்று இடுதல்	வாழ்வியல் தத்துவம்	நெடுந்தொடர்	மரபுக்கவிதை
	SLO-2	பயன்பாட்டுத்தமிழ்	வல்லினம் மிகும் இடங்கள்	பழமொழிகள்	பத்தி எழுதுதல்	வசனகவிதை
S-3	SLO-1	காலந்தோறும் தமிழ்	வல்லினம் மிகா இடங்கள்	பழமொழியும் மனித வாழ்வியலும்	ஒரு பொருளை மையமாகக் கொண்டு எழுதுதல்	புதுக்கவிதை புதிய வடிவக் கவிதைகள்
	SLO-2	எழுத்துகள் - அறிமுகம்	எழுத்துப்பிழை நீக்கம்	பழமொழியின் வடிவம்	காலந்தோறும் கடிதங்கள்	கவிதைக் களங்கள்

S-4	SLO-1	தமிழ் எழுத்து வரலாறு	பிழை நீக்கி எழுதுதலின் அவசியம்	வட்டார மொழி	தமிழில் கடித இலக்கியம்	கவிதை உள்ளடக்கம்
	SLO-2	எழுத்துகளின் வரிவடிவம்	பிழைகளும் மொழிச் சிக்கல்களும்	வட்டார மொழியில் சொலவடை	கடித வகைகள்	கவிதை எழுதும் முறை
S-5	SLO-1	எழுத்துகளின் பிறப்பு	எதிர்ச்சொல் வரலாறு	பழமொழியும் சொலவடையும்	கடிதம் எழுதும்முறை	தன்னுணர்ச்சிக் கவிதை
	SLO-2	உயிர் எழுத்துப் பிறப்பு	எதிர்ச்சொல்லின் உருவாக்கம்	பேச்சுநடையும் சொலவடையும்	அலுவல் கடிதம்	இயற்கை சமூகம் - கவிதை
S-6	SLO-1	மெய்யெழுத்துப் பிறப்பு	இணைச்சொல்லும் எதிர்ச்சொல்லும்	மரபுத்தொடர்	வாழ்த்து/ பாராட்டுக் / நட்புக் கடிதம்	காலந்தோறும் கதைகள்
	SLO-2	மொழி முதல் எழுத்துகள்	தமிழில் எதிர்ச்சொற்கள்	பழமொழி மரபுத் தொடர் வேறுபாடு	கட்டுரை வகைகள்	கதைகளில் கற்பனையும் உண்மையும்
S-7	SLO-1	மொழி இறுதி எழுத்துகள்	ஓரெழுத்து ஒருமொழி – அறிமுகம்	தமிழில் மரபுத்தொடர்	கட்டுரை எழுதும் முறை	வாய்மொழிக் கதை
	SLO-2	எழுத்து வேறுபாடும் பொருளும்	ஓரெழுத்து ஒருமொழியும் பொருளும்	விடுகதை	கட்டுரைக் களங்கள்	ஒரு பக்கக் கதை
S-8	SLO-1	ணகர - னகர - நகர வேறுபாடு	சொற்களின் தன்மைகள்	நுண்ணறிவு வெளிப்படுதல்	போட்டிக் கட்டுரை	சிறுகதை
	SLO-2	லகர – ளகர - ழகர வேறுபாடு	ஒரு சொல் பல பொருள்	கதை மரபில் நாட்டுப்புறக் கதைகள்	அனுபவக் கட்டுரை	கதை எழுதும் முறை
S-9	SLO-1	சொல்லும் பொருளும்	ஒரு பொருள் பல சொல்	தமிழில் நாட்டுப்புறக் கதைகள்	பயணக் கட்டுரை	சமூக உணர்வின் வெளிப்பாடு
	SLO-2	காலந்தோறும் சொற்கள்	சொல் உருவாக்கத்தின் பயன்கள்	நாட்டுப்புறக் கதைகளும் சமூக வரலாறும்	இதழியல் கட்டுரைகள்	நிகழ்வைக் கதை வழியே வெளியிடல்

Learning Resources	1. நல்ல தமிழ் எழுத வேண்டுமா?, அ. கி. பரந்தாமனார், பாரி நிலையம், 2010. 2. நாட்டுப்புற இயல் ஆய்வு, சு. சக்திவேல், மணிவாசகர் பதிப்பகம், சென்னை, 2006. 3. படைப்புக்கலை, மு. சுதந்திரமுத்து, அறிவுப் பதிப்பகம், சென்னை, 2008. 4. கதையியல், க. பூரணச்சந்திரன், அடையாளம் பதிப்பகம், சென்னை, 2012. 5. இணைய வழித் தரவுகள் : https://tamilheritage.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%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. P.R.Subramanian, Director, Mozhi Trust, Thiruvanmiyur, Chennai – 600 041.	*1. Dr. V. Dhanalakshmi, Associate Professor, Subramania Bharathi School of Tamil Language & Literaturel, Pondicherry University, Pondicherry*	*1. Dr. B.Jaiganesh, Associate Professor & Head, Dept. of Tamil, FSH, SRMIST,KTR*
		2. Dr. R. Ravi, Assistant Professor and Head, Dept. of Tamil, FSH, SRMIST, VDP.
		3. Mr. G. Ganesh, Assistant Professor, Dept. of Tamil, FSH, SRMIST, RMP.
		4. Dr. T.R.Hebzibah beulah Suganthi, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.
		5. Dr. S.Saraswathy, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.

Course Code	ULH23AE1J	Course Name	APPLIED HINDI-I	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Explain and appreciate the Constant moral values of India			
CLR-2 :	Focus on Evaluating the social changes through prose			
CLR-3 :	To Display moral and social values in the field of religion and communal Unity			
CLR-4 :	To make translation of good literature and any relevant document from the Hindi Language to English and vice –versa			
CLR-5 :	To help the learners to tackle Administrative terminology			

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	PSO -1	PSO -2	PSO-3
CLO-1 :	***Understand the various forms of Prose and different aspects of social issues***	2	75	80	H	H	H	M	L	H	L	M	L	L	H	M	-	-	-
CLO-2 :	***To create an awerness on Ramayanan***	2	80	90	H	H	H	M	L	H	H	M	L	L	H	M	-	-	-
CLO-3 :	***To Examine the accuracy in Translation***	2	75	95	H	H	M	L	H	H	M	H	M	M	H	H	-	-	-
CLO-4 :	*To Provide technical writing skills*	2	80	90	H	H	L	H	M	H	L	H	H	M	H	H	-	-	-
CLO-5 :	***To evaluate the nuance in essays***	2	85	90	M	H	M	H	L	H	H	L	H	M	H	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	KAHANI	NIBANDH	BAL RAMAYAN	ANUVAD	PARIBHASHIK SHABDAVALI
	SLO-2	AVDHARNA	VDHARNA	HATHA VASHTU	AVDHARNA	RTH
S-2	SLO-1	ARTH	RTH	VADHPURI MEN RAM	RTH	ARIBHASHA
	SLO-2	SWARUP	WARUP	RAM KE ADARSH KE PRATI PRERIT KARNA	SWARUP	WARUP
S-3	SLO-1	PARIBHASHA	ARIBHASHA	AMAYAN KE PRATI RUCHI JAGANA	PARIBHASHA	RAKAR
	SLO-2	KAHANI KE TATVA	MAHABHARAT KE SAMAY KA BHARAT-HALKRISHNA BHATT	AMAYAN KA SAMAJ MEN MAHATVA	PRAKAR	VADHARNA
S-4	SLO-1	UDDESHYA	EKHAK PARICHAYA	OKJEEVAN KE PRATI JAGRUP KARNA	MAHATVA	RAYOJAN
	SLO-2		ATH KA VISLESHAN	JANGAL AUR JANKPUR	UDDESHYA	DDESHYA
S-5	SLO-1	ANTASH MAN KI JAGRITI	DDESHYA	GURU KE PRATI ADAR BHAV	ANUBAD PRAKRIYA	MAHATVA
	SLO-2	EIDGAH – KAHANI PREMCHAND	AMAJIK SAMRASTA	IRTA KE BHAV KO JAGANA	VIVIDH PRAYOG	RAYOG

S-6	SLO-1	KAHANI KA PARICHAYA	PAURANIK KAHANIYO SE AVAGAT KARANA	VIDHARM KA PRATIFAL	HINDI SE ANGREZI ANUVAD	IDDESHYA
	SLO-2	KAHANI VISLESHAN	MAHABHARAT EVAM RAMAYAN KE SAMAJ KI TULNA	VAN JEVAN SE AVAGAT KARANA	ANGREZI SE HINDI ANUVAD	AKANIKI SHABDAVALI KA MHATVA
S-7	SLO-1	BAL MANOVIGYAN	BABUL AUR KAKTASH-RAMDARASH MISHRA	SITA KE ADARSH CHARITRA SE AVAGAT KARANA	NUVAD KA PRAYOJAN	HINDI SE ANGREZI SHABD
	SLO-2	ASMANTA KA CHITRAN	LEKHAK PARICHAY	RAM KE CHARITRA SE AVAGAT KARANA	NUVAD KA PRAYOG	ANGREZI SE HINDI SHABD
S-8	SLO-1	DIP SE DIP JALE- USHA YADAV	PATH KA VISLESHAN	VIRTA KE BHAV JAGANA	HROT BHASHA KA GYAN	EK DIN EK SHABD
	SLO-2	SAPNE KE LIYE SANGHARSH	MANVATA KO JIVIT RAKHANE KI PRERNA	PATH KA VISLESHAN	LAKSHYA BHASHA KA GYAN	SHABDON KA VISLESHAN
S-9	SLO-1	SAMASYA KA SMADHAN JAD MEN HOTA HAI	AAJ KE SANDARBH ME MAHABHARAT KI UPYOGITA	PATH PRICHARCHA	ANUVAD KA DAYITVA	PATH PRICHARCHA
	SLO-2	PRASHNABHAYASH	PRASHNABHAYASH	PRASHNABHAYASH	ANUVAD KA ABHYASH	PRASHNABHAYASH

Learning Resources	***Edited Book: "PRAYOJAN MULOK HINDI", SRIJONLOK PUBLICATION, 2023, New Delhi.*** 1. Srijanlok Literary Magazine, Ara (Bihar – 802301) 2. https://hindisamay.com/ 3. https://ncert.nic.in/textbook.php?fhbr1=0-12 ***4.*** Prayojan mulak Hindi, Dr. Sontakke ***5.*** https://rajbhasha.gov.in/hi/ol_clause	*PUNRIKSHAN*

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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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	Experts from Higher Technical Institutions	Internal Experts
Shri. Santosh Kumar Editor : Srijanlok Magazine Place: Vashishth Nagar, Ara – 802301	*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
		4, Dr.Nisha Murlidharan Assistant Professor, VDP,SRM IST

Course Code	ULF23AE1J	Course Name	French for Specific purpose-I	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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:*
CLR-1 :	Strengthen the language of the students both in oral and written
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

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*To acquire knowledge about French language*	2	75	80	H	M	H	H	M	H	H	L	M	M	H	L	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	2	80	90	M	H	L	H	H	M	H	M	L	L	H	M	-	-	-
CLO-3 :	*To develop content using the features in French language*	2	75	80	H	H	L	M	H	M	L	H	M	M	H	H	-	-	-
CLO-4 :	*To interpret & Translate the French language into other language*	2	75	90	H	L	M	H	M	H	H	M	L	H	M	L	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	2	80	75	M	H	H	L	M	M	H	H	M	L	H	M	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	**TP de chimie**	**Le jour des examens**	L'impératif négatif	Comprendre une lettre de motivation	Comprendre la structure d'un rapport de stage
	SLO-2	Les exemples	Les activités	-Le passé composé avec être	Les exemples	Trouver des mots clés-
S-2	SLO-1	- Un TP au laboratoire-	Le sms à la française -	Les exemples	Repérer le présent	Les activités
	SLO-2	Les exemples	Les activités	Le passé composé des verbes pronominaux	Les activités	Comprendre un texte technique-
S-3	SLO-1	Comprendre un TP	Les examens	**-La recherche de stage** -	, le passé composé et	Les activités
	SLO-2	Les exemples	Les activités	Les exemples	Les activités	Les exemples
S-4	SLO-1	-Suivre un protocole expérimental -	-Donner des conseils	Les activités	le futur dans un texte	Relever des arguments dans un texte-
	SLO-2	Les activités	Les exemples	Le stage en France	Les exemples	Les activités
S-5	SLO-1	Lire des équations chimiques -	-Écrire et comprendre un sms -	Les activités	**- Le rapport de stage et le domaine des carburants** -	Les exemples
	SLO-2	Les activités	Comprendre une interdiction	Le CV français	Les activités	Les activités
S-6	SLO-1	Identifier des formules chimiques à l'oral	Les activités	Les exemples	Le stage	Les activités
	SLO-2	Les exemples	-Donnez des consignes -	La lettre de motivation-	Les exemples	Les pronoms COI

S-7	SLO-1	- L'infinitif pour exprimer un ordre ou	Les exemples	Comprendre une offre de stage	La méthode du plan détaillé-	Les exemples
	SLO-2	Les activités	Comprendre	Les exemples	Les activités	Les exemples
S-8	SLO-1	un conseil (dans les consignes) -	Les exemples	Les activités	Les exemples	Les activités
	SLO-2	Les exemples	et parler d'actions passées-	Comprendre et réaliser un CV	Le contenu du rapport de stage	Quelques verbes et leur préposition
S-9	SLO-1	La nominalisation	Les exemples	Les activités	Les exemples	Les activités
	SLO-2	Les exemples	L'impératif des verbes pronominaux	Les exemples	Les activités	Les exemples

Learning Resources	***Theory:*** 1. **"*Tech French*"** French for Science and Technology, Ingrid Le Gargasson, Shariva Naik, Claire chaize, Les éditions Didier, India, 2011. 2. *https://www.fluentu.com/blog/french/french-grammar* 3. *https://www.elearningfrench.com/learn-french-grammar-online-free.html* 4. *https://www.lawlessfrench.com/grammar* 5. *https://blog.gymglish.com/2022/12/15/basic-french-grammar*

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 (5%)#**			
		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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. Mr. Kavaskar Danasegarane Process Expert Maersk Global Service Center Pvt. Ltd	*1. Dr. C.Thirumurugan Professor, Department of French, Pondicherry University*	*1. Mr. Kumaravel K. Assistant Professor & Head, SRMIST, KTR*
2.Mr. Sharath Raam Prasad Character Designer, Animaker Company Pvt.		*2. Mrs. Abigail, Assistant Professor, SRMIST, VDP*

Course Code	UMA23D01T	Course Name	FUZZY MATHEMATICS	Course Category	D	*Discipline Specific Elective Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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 :	*To know the basic definitions of fuzzy set theory*																		
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 learn the fundamentals of fuzzy algebra*																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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 :	*To get exposed to fuzzy sets, fuzzy subsets and their properties*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*To be capable enough to use the arithmetic operations involved in fuzzy sets effectively*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To have a better understanding of fuzzy logic*	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To be familiar with fuzzy relations and to do problems based on it*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*To be familiar with the fundamentals of fuzzy algebra*	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	**SLO-1**	Overview of crisp sets	Introductions to operations on fuzzy subsets	Introduction to crisp relations	Introduction to some more connectives exclusive OR, NAND, NOR	Definition of invariant subgroups
	SLO-2	Introduction to fuzzy sets	Illustrations related to operations on fuzzy subsets	Introduction to fuzzy relations	Real life examples	Example of invariant fuzzy subgroups
S-2	**SLO-1**	Examples of fuzzy sets	Definition of empty fuzzy subset and universal fuzzy subset	Algebra of fuzzy relations	Introduction to fuzzy logic	Example of invariant fuzzy subgroups
	SLO-2	Definition of fuzzy subsets	Disjoint fuzzy subsets	Definition of a binary relation	Fuzzy propositions	Proofs of propositions on invariant fuzzy subgroups
S-3	**SLO-1**	Examples of fuzzy subsets	Properties of fuzzy subsets of a set	Examples based on fuzzy relation	Unconditional and qualified propositions Conditional and unqualified propositions	Proofs of propositions on invariant fuzzy subgroups
	SLO-2	Definition and example of partially	Proofs of the properties of fuzzy subsets	Introduction to union,	Fuzzy Quantifiers	Proofs of propositions on invariant fuzzy

		ordered sets	of a set.	intersection of fuzzy relations	Linguistic Hedges, Fuzzy subgroupoids	subgroups
S-4	**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-5	**SLO-1**	Types of fuzzy sets and examples for different types of fuzzy sets	Algebraic sum of two fuzzy subsets.	Examples on union, intersection of fuzzy relations	Introduction to fuzzy subgroupoids	Proofs of propositions on invariant fuzzy subgroups
	SLO-2	.Operations on fuzzy sets.	Algebraic product of two fuzzy subsets.	Definition of algebraic sum and product of fuzzy relations.	Theorems on subgroupoids	Proofs of propositions on invariant fuzzy subgroups
S-6	**SLO-1**	Alpha cuts of fuzzy sets.	Properties of algebraic sum and product of two fuzzy subsets.	Introduction to composition and complement of fuzzy relations	Theorems on subgroupoids	Definition of fuzzy subrings
	SLO-2	Properties of alpha cuts	Fuzzy subset function definition	Similarity relation	Introduction to lattice of fuzzy subgroupoids.	Examples
S-7	**SLO-1**	Representation of fuzzy sets in terms of alpha cuts. Additional properties of alpha cuts.	Illustration of a fuzzy subset function	Introduction to fuzzy preorder and fuzzy partial order relation.	Theorems on lattice of fuzzy subgroupoids.	Proofs of propositions on fuzzy subrings
	SLO-2	Lattices and Boolean Algebra Examples of a Lattice	Theorems based on fuzzy subset function	Introduction to classical logic	Proofs of propositions of homomorphic image of a fuzzy groupoid.	Proofs of propositions on fuzzy subrings
S-8	**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-9	**SLO-1**	L-Fuzzy sets	Theorems based on fuzzy subset function	Discussion of statements and sentences	Proofs of propositions.	Proofs of propositions on fuzzy subrings
	SLO-2	Properties of L-fuzzy sets	Theorems on fuzzy subset function	Introduction	Definitions of fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-10	**SLO-1**	Visual representation of fuzzy subsets	Cartesian product of fuzzy subsets	Different types of Connectives	Theorems involving fuzzy subgroups	Proofs of propositions on fuzzy subrings
	SLO-2	Examples of fuzzy subsets	Vector sum and scalar multiplication of fuzzy subsets.(definition only)	Propositional laws relating to logical connectives.	Theorems involving fuzzy subgroups	Proofs of propositions on fuzzy subrings
S-11	**SLO-1**	Examples of fuzzy subsets	Vector sum and scalar multiplication of fuzzy subsets.	Definition of a tautology	Theorems involving fuzzy subgroups	Proofs of propositions on fuzzy subrings
	SLO-2	More examples.	Examples	Examples for dual of two connectives.	Theorems involving fuzzy subgroups	Proofs of propositions on fuzzy subrings
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

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 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
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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. Melita Vinoliah,** **melitav@srmist.edu.in**

Course Code	UMA23D02T	Course Name	Cryptography	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	To introduce students to the basic concepts and techniques of cryptography	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 :	Understanding of the cryptography theories and algorithms																		
CLR-3 :	To study the various symmetric key cryptography																		
CLR-4 :	To study the various public key cryptography																		
CLR-5 :	To learn message authentication and integrity																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Understand the basic concepts and techniques of cyber security	4	85	80	*H*	*H*	-	*H*	*M*	-	-	-	-M	-	-	*H*	-	-	-
CLO-2 :	Identify and apply symmetric key cryptography	4	85	80	*H*	*H*	-	*M*	*M*	-	-	-	*M*	-	-	*H*	-	-	-
CLO-3 :	Apply the public key cryptography algorithms for any given problem	4	85	80	*H*	*H*	*M*	*H*	*M*	-	-	-	*M*	-	-	*H*	-	-	-
CLO-4 :	Understand the message authentication and integrity	4	85	80	*H*	*H*	*M*	*H*	*M*	-	-	-	*M*	-	-	*H*	-	-	-
CLO-5 :	Design systems that uses the appropriate security technique	4	85	80	*H*	*H*	*M*	*H*	*M*	-		-	*M*	-	-	*H*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction	Algebraic structures-Modular arithmetic	Mathematics of Asymmetric Key Cryptography: Primes	Authentication requirement	Introduction
	SLO-2	Security Trends	Euclid's algorithm	Primality Testing	Authentication function	Overview of different application
S-2	SLO-1	Security Attacks	Congruence and matrices -Groups, Rings	Factorization	MAC	Electronic Mail security – PGP
	SLO-2	Security Services	Fields- Finite fields	Euler's totient function	Hash function	Electronic Mail security – PGP
S-3	SLO-1	Security Mechanisms	Symmetric Key Ciphers– Block cipher	Fermat's and Euler's Theorem	Security of hash function and MAC	S/MIME
	SLO-2	Model for Network Security	Principles of DES	Chinese Remainder Theorem	Security of hash function and MAC	S/MIME

S-4	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-5	SLO-1	Substitution Technique	Differential and linear cryptanalysis	RSA cryptosystem	Digital signature and authentication protocols	Web Security
	SLO-2	Substitution Technique	Differential and linear cryptanalysis	RSA cryptosystem	Digital signature and authentication protocols	Web Security
S-6	SLO-1	Transposition Technique	Block cipher mode of operation	Key management	Entity Authentication: Biometrics	System Security: Intruders
	SLO-2	Transposition Technique	Block cipher mode of operation	Key management	Entity Authentication: Biometrics	System Security: Intruders
S-7	SLO-1	Rotor Machines	Evaluation criteria for AES	Diffie Hellman key exchange	Challenge response protocols	Malicious software
	SLO-2	Rotor Machines	Evaluation criteria for AES	Diffie Hellman key exchange	Challenge response protocols	Malicious software
S-8	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-9	SLO-1	Rotor Machines	Evaluation criteria for AES	Diffie Hellman key exchange	Challenge response protocols	Malicious software
	SLO-2	Rotor Machines	Evaluation criteria for AES	Diffie Hellman key exchange	Challenge response protocols	Malicious software
S-10	SLO-1	Steganography	RC4	Elliptic curve arithmetic	Authentication applications	Viruses
	SLO-2	Foundations of modern cryptography: perfect security	RC4	Elliptic curve arithmetic	Authentication applications	Viruses
S-11	SLO-1	Product cryptosystem – cryptanalysis	Key distribution.	Elliptic curve cryptography	Kerberos, X.509	Firewalls.
	SLO-2	Product cryptosystem – cryptanalysis	Key distribution.	Elliptic curve cryptography	Kerberos, X.509	Firewalls.
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

Learning Resources	1. William Stallings, Cryptography and network security (Principles and practice), Fourth Edition, Prentice Hall, 2005. 2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, John Wiley & Sons, Inc, 2nd Edition, 2007. Niall Adams ◦ Nicholas Heard, Data Analysis for Network Cyber-Security, Imperial College Press, 2014.	3. EC-Council, Ethical Hacking and Countermeasures: Attack Phases, Cengage Learning, 2009. 4. Izzat Alsmadi, Chuck Easttom , Lo'ai Tawalbeh , The NICE Cyber Security Framework: Cyber Security Management 1st Edition, Kindle Edition, 2008. 5. Martti Lehto Pekka Neittaanmäki, Cyber Security: Analytics, Technology and automation, Intelligent Systems, Control and Automation: Science and Engineering, Springer, 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
Mr. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr.V.Muthukumaran, muthukuv2@srmist.edu.in

Course Code	UCY23G01J	Course Name	Basic Chemistry	Course Category	G	Generic Elective Course	L	T	P	O	C
							3	0	3	2	4

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:*	**Learning**
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 :	Understand the basic principles of chemical kinetics	
CLR-4 :	Study the concepts in electrochemistry	
CLR-5 :	Make aware of the fuels, fertilizers and other detergents	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Program Learning Outcomes (PLO)														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			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 :	Gain knowledge on the basics in organic chemistry.	*4*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Promote the importance of silicon and metals.	*4*	-	-	-	-	*H*	-	*H*	-	-	-	-	-	-	-	-
CLO-3 :	Understand the facts in chemical kinetics	*4*	-	-	-	-	*M*	-	*H*	-	-	-	-	-	-	-	-
CLO-4 :	Acquire knowledge in the principles of electrochemistry	*4*	-	-	-	*H*	-	-	*H*	-	-	-	-	-	-	-	-
CLO-5 :	Understand the basic concepts in industrial chemistry	*4*	-		*H*	-	-	*H*	-	-	-	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	**SLO-1**	Introduction of Hybridisation and Isomerism: Hybridisation - sp, sp^2	Addition reactions:	Coordination Chemistry: Nomenclature	Electrochemistry: Introduction	soaps. - structure and cleansing action
	SLO-2	sp^3 Hybridisation	Nucleophilic Addition reactions:	isomerism of coordination compounds	Faradays laws of electrolysis	Soap-examples
S-2	**SLO-1**	Bond length- bond angle- dipole moment	Electrophilic Addition reactions:	EAN rule	Specific conductance, equivalent conductance	Detergents - structure and cleansing action
	SLO-2	inductive effect- mesomeric effect and hyperconjucation	Free radical Addition reactions	VB Theory	Cell constant	Detergent - examples

Duration (hour)		15	15	15	15	15
S-3	SLO-1	Isomerism- geometrical and optical isomerism	Elimination rections	Crystal field theories of octahedral complexes	Arrhenius theory of electrolytic dissociation	Industrial Chemistry: Introduction-Fuel gas
	SLO-2	Structural isomers andstereoisomers	E1, E2, E1cb mechanism	tetrahedral and square planar complexes	Arrhenius theory of electrolytic dissociation-explanation	Water gas
S-4-6	SLO-1	Lab Introduction	Estimation of ascorbic acid	Estimation of $KMnO_4$using standard potassium dichromate	Determination of strength of an acid – Conductometric titration	Estimation of Nickel using decinormal solution of EDTA
	SLO-2					
S-7	SLO-1	Configurations, chirality	Chemistry of Hydrogen	Chemical Kinetics: Rate of reaction	Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.	producer gas
	SLO-2	Elements of symmetry	Isotopes of hydrogen	order- molecularity	Molar conductivity at infinite dilution	LPG gas
S-8	SLO-1	Enantiomers	Occurrence- extraction of iron	first order rate law and simple problems	Ostwald"s dilution law	Gobar gas and
	SLO-2	diastereomers	Occurrence- extraction of cobalt	Half-life period of first order reaction	Activity- Ostwald"s dilution law	natural gas
S-9	SLO-1	Conformational analysis - ethane	Occurrence- extraction of nickel	pseudo first order reaction	Kohlrausch law of independent migration of ions	Fertilizers – Mixed fertilizer
	SLO-2	Conformational analysis – n-butane	Occurrence- extraction of copper	zero and second order reactions	Problems - Kohlrausch law of independent migration of ions	NPK fertilizer
S-10-12	SLO-1	Estimation of HCl using standard oxalic acid	Estimation of Copper using decinormal solution of Potassium dichromate solution	Determination of rate of the reaction – Ester hydrolysis	Determination of strength of mixture of acids – Conductometric titration	Estimation of $K_2Cr_2O_7$ using decinormal solution of Sodium thiosulphate solution
	SLO-2					
S-13	SLO-1	Nucleophilic substitution reactions	structure of borazole	Arrhenius theory-Postulates	Nernst equation -Derivation	Hardness of water – Temporary and permanent hardness
	SLO-2	SN1 mechanism	Preparation of borazole	Explanation and limitation	Problems – Nernst equation	disadvantages of hard water
S-14	SLO-1	SN2 mechanism	Chemistry of Silicon compounds	Collision theories- Postulates	Nernst equation applications	Boiler scales and sludges
	SLO-2	Free radical mechanism	Structure and Preparation of SiO_2	Explanation and limitation	Nernst equation application to different kinds of half-cells	Softening of hard water – Zeolite process
S-15	SLO-1	Electrophilic substitution reactions	Structure and Preparation of SiC	Problems/activities related to kinetics	Kohlrausch law of independent migration of ions	demineralization process - Principle
	SLO-2	Mechanism	Structure and Preparation of $SiCl_4$	Problems/activities related to kinetics	Ostwald"s dilution law	demineralization process - Procedure
S-16-18	SLO-1	Estimation of phenol / aniline	Estimation of NaOH using standard sodium carbonate	Estimation of FAS using standard oxalic acid	Redox titration by Potentiometric method	Estimation of hardness by EDTA method
	SLO-2					

Learning Resources	**Theory:** 1. M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3rd ed., McGraw-Hill publishers, 1980. 2. P. W. Atkins, J. Paula, J. Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2018. 3. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014. 4. J. C. Kuriacose, J. Rajaram, Chemistry in Engineering and Technology, Tata McGraw-Hill Education, 1984. 5. A. Wieckowzki, J. Norskov, and Gottesfel, Fuel Cell Science: Theory, Fundamentals, and Biocatalysis, 2010 6. B. H. Mahan, R. J. Meyers, University Chemistry, 4th ed., Pearson publishers, 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	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

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

Course Designers		
Expert from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***
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	Prof. Sukhendu Mandal, Department of Chemistry, IIISER, Thiruvananthapuram Email: sukhendu@iisertvm.ac.in	*2. Prof. Dr. M. Arthanareeswari, SRM IST*

Course Code	UPY23G01J	Course Name	Allied Physics	Course Category	G	Generic Elective Course	L	T	P	O	C
							3	0	3	2	4

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		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1:	*understand the fundamentals of physics*			
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*			
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
CLO-2 :	*Acquire knowledge on materials properties*	2	80	70
CLO-3 :	*Correlate the acquired knowledge and use it for various applications*	2	75	70
CLO-4 :	*Familiarize themselves with interaction of light and matter*	2	80	75
CLO-5 :	*Apply physics methods and principles to solve problems in the majors.*	2	80	75

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
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	
H	*H*						*H*				*H*				
H	*H*						*H*				*H*				
H	*H*						*H*				*H*				
H	*H*						*H*				*H*				
H	*H*						*H*				*H*				

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Sources of conventional energy*	*Space lattice basis*	*Kinetic theory of gases*	*Electric charge - conservation of charge, Permittivity*	*Time period - amplitude - phase*
	SLO-2	*Need for non - conventional energy resources*	*Unit Cell, lattice parameters*	*Ideal gas laws*	*Coulomb's law*	*Wave nature of light*
S-2	SLO-1	*Solar energy and solar cells and its applications*	*Two dimensional and three dimensional Bravais lattices*	*Van Der Waal's equation of states*	*Electric field*	*Huygens's principle*
	SLO-2	*Bio mass energy*	*The seven crystal systems*	*Derivation of Van Der Waal's equation of states*	*Electric potential*	*Interference and Coherence*
S-3	SLO-1	*Generation and applications of bio mass energy*	*Cubic crystal system and symmetry*	*Pressure of an ideal gas*	*Gauss's law*	*Young's double slit experiment*
	SLO-2	*Wind energy generation and applications*	*Reciprocal lattice and its importance*	*Derivation of Pressure of an ideal gas*	*Applications of Gauss's law*	*Interference from thin films*
S-4 to S-6	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-7	SLO-1	*Nuclear energy - Atomic structure*	*Density and atomic packing fraction*	*Laws of thermodynamics*	*Conductors and dielectrics*	*Michelson's interferometer*
	SLO-2	*Alpha, beta and gamma radiation*	*Crystal directions and planes*	*Entropy*	*Electric Current*	*Diffraction - Wave theory of light*
S-8	SLO-1	*Law of radioactive decay, Decay constant*	*Introduction to Miller indices*	*Change of entropy in reversible processes*	*Ohm's law*	*Light and Optics*
	SLO-2	*Half-life and mean life*	*Interplanar distance*	*Change of entropy in irreversible processes*	*Magnetic induction*	*Fermat's principle*

S-9	**SLO-1**	*Nuclear energy*	*Hexagonal closely packed (HCP) structure*	*Low temperature*	*Permeability and susceptibility*	*Laws of reflection and refraction*
	SLO-2	*Applications of nuclear energy*	*Derivation of HCP atomic packing fraction*	*Joule - Kelvin effect-introduction*	*Numerical Problems/Demos/ Simulations/Seminars on Permeability and susceptibility*	*Total internal reflection*
S-10 to S-12	**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-13	**SLO-1**	*Mass defect*	*Diamond crystal structure*	*J-K effect- theory*	*Magnetic field due to a current carrying conductor-Biot-Savart's law*	*Mirrors and lenses*
	SLO-2	*Nuclear binding energy*	*Derivation of APF for diamond structure*	*Applications of J-K effect*	*Ampere's circuital law*	*Lens makers formula*
S-14	**SLO-1**	*Fission reaction*	*X-ray diffraction*	*Linde's process*	*Faraday's law*	*Defects of images*
	SLO-2	*Evaluating nuclear energy generation by fission reaction*	*Problems/Demos/ Simulations/Seminars on X-ray diffraction*	*H, He, Nitrogen gas liquefaction*	*P and N type semiconductors*	*Coma distortion*
S-15	**SLO-1**	*Fusion reaction*	*Single crystal diffraction*	*Adiabatic demagnetization-introduction*	*Junction Diode*	*Spherical aberration in lenses*
	SLO-2	*Fusion energy cycles*	*powder diffraction*	*Working principle of adiabatic demagnetization-*	*Characteristics of Junction Diode*	*Chromatic aberration in lenses*
S-16 to S - 18	**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 Understand	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %
Level 2	Apply Analyze	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %
Level 3	Evaluate Create	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications 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	UMA23S01L	Course Name	C Programming	Course Category	S	*Skill Enhancement Course*	*L*	*T*	*P*	*O*	*C*
							0	0	2	2	1

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
CLR-1 :	Think and evolve a logically to construct an algorithm into a flowchart and a pseudocode that can be programmed	
CLR-2 :	Utilize the logical operators and expressions to solve problems in engineering and real-time	
CLR-3 :	Store and retrieve data in a single and multidimensional array	
CLR-4 :	Utilize custom designed functions that can be used to perform tasks and can be repeatedly used in any application	
CLR-5 :	Create storage constructs using structure and unions. Create and Utilize files to store and retrieve information	

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 :	Identify methods to solve a problem through computer programming. List the basic data types and variables in C	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Apply the logic operators and expressions. Use loop constructs and recursion. Use array to store and retrieve data	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Analyze programs that need storage and form single and multi-dimensional arrays. Use preprocessor constructs in C	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Create user defined functions for mathematical and other logical operations.	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Create structures and unions to represent data constructs. Use files to store and retrieve data	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (6)	Module-II (6)	Module-III (6)	Module-IV (6)	Module- V (6)
S-1	SLO-1	Evolution of Programming & Languages	Increment and decrement operator	Iterations, Conditional and Unconditional branching	Array Programs – 2D	Function with and without Arguments and no Return Values
	SLO-2	Problem solving through programming	Increment and decrement operator	For loop	Array Contiguous Memory	Function with and without Arguments and Return Values
S-2	SLO-1	Input and output functions: Printf and scanf	Comma, Arrow and Assignment operator	While loop	Array Advantages and Limitations	Passing Array to Functions with return type
	SLO-2	Variables and identifiers	Bitwise and Sizeof operator	do while, goto, break, continue	Array construction for real-time application Common Programming errors	Recursion Functions
S-3	SLO-1	Expressions	Relational and logical Operators	Array Basic and Types	String Basics	Passing Array Element to Function

	SLO-2	Single line and multiline comments	Condition Operators, Operator Precedence	Array Initialization and Declaration	String Declaration and Initialization	Formal and Actual Parameters
S-4	SLO-1	Constants, Keywords	Expressions with pre / post increment operator	Initialization: one Dimensional Array	String Functions: gets(), puts(), getchar(), putchar(), printf()	Advantages of using Functions
	SLO-2	Values, Names, Scope, Binding, Storage Classes	Expression with conditional and assignment operators	Accessing, Indexing one Dimensional Array Operations	String Functions: strlen, strcat, strcmp	Processor Directives and #define Directives
S-5	SLO-1	Numeric Data types: integer	If statement in expression	One Dimensional Array operations	String Functions: sprint, sscanf, strrev, strcpy, strstr, strtok	Nested Preprocessor Macro
	SLO-2	Numeric Data types: floating point	L value and R value in expression	Array Programs – 1D	Arithmetic Characters on Strings	Advantages of using Functions
S-6	SLO-1	Non-Numeric Data types: char and string	Control Statements – if and else	Initializing and Accessing 2D Array	Functions declaration and definition	Nested Preprocessor Macro
	SLO-2	Non-Numeric Data types: char and string	else if and nested if, switch case	Initializing Multidimensional Array	Types: Call by Value, Call by Reference	Advantages of using Functions

Learning Resources	*1. Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015* *2. Bharat Kinariwala, Tep Dobry, Programming in C, eBook.* *3. Dan Gookin, C Programming for Dummies,* John Wiley & Sons, Inc**.,** 2021.	*4. W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd ed. Prentice Hall, 1996* *5. http://www.c4learn.com/learn-c-programming-language/* *6. Sri Manikanta palakollu, Practical System Programming with C, Apress, 2021.*

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2.Dr. M. Suresh** sureshm@srmist.edu.in

Course Code	UMA23P01L	Course Name	Internship – I	Course Category	P	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	0	0	1

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:
CLR-1 :	Gain practical experience within the business environment.
CLR-2 :	Acquire knowledge of the industry in which the internship is done.
CLR-3 :	Apply knowledge and skills learned in the classroom in a work setting
CLR-4 :	Develop a greater understanding about career options while more clearly defining personal career goals
CLR-5 :	Experience the activities and functions of business professionals.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)
CLO-1 :	Identify areas for future knowledge and skill development	3	80	70
CLO-2 :	understanding of what is expected in the job market and what their standard of performance should be	3	85	75
CLO-3 :	Build professional, as well as academic, contacts and begin the process of networking and support for your future careers.	3	75	70
CLO-4 :	Acquire knowledge of the industry in which the internship is done.	3	85	80
CLO-5 :	practical experience within the business environment	3	85	75

	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
CLO-1 :	H	H	-	-	-	-	-	-	-	-	M	-	-	-	-
CLO-2 :	H	H	-	-	-	-	-	-	-	-	M	-	-	-	-
CLO-3 :	H	H	-	-	-	-	-	-	-	-	M	-	-	-	-
CLO-4 :	H	H	-	-	-	-	-	-	-	-	M	-	-	-	-
CLO-5 :	H	H	-	-	-	-	-	-	-	-	M	-	-	-	-

PROCESS	
Stage I	Identifying area of interest
Stage II	Review I
Stage III	Review II
Stage IV	Review III
Stage V	Final Submission of the Project Report (Thirty pages minimum)

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. **.Dr. R. Perumal** perumalr@srmist.edu.in

Course Code	UCD23V02T	Course Name	Industry Oriented Employability Skills for Science	Course Category	V	Value Addition course	L	T	P	O	C
							2	0	0	2	2

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Demonstrate various principles involved in solving mathematical concepts related to permutation and combination and probability and interpret data*
CLR-2 :	*Learn the basic mechanics of grammar and develop resume-building practice and presentation skills in students*
CLR-3 :	*Understand the object oriented features*
CLR-4 :	*Prepare students for job interviews*
CLR-5 :	*Instill confidence in students and develop the necessary skills to face interview*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Understand the concepts of permutation and combinations, probability and approach questions in a simpler and innovative method*	3	80	70
CLO-2 :	*Understand the different parts of speech and use them in sentences appropriately and also the importance of resume preparation*	3	85	75
CLO-3 :	*Understand the importance of object oriented features*	3	85	80
CLO-4 :	*Face interviews confidently*	3	85	80
CLO-5 :	*Develop their domain skills to face the interview*	3	85	80

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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 Behaviour	Life Long Learning
M	M	-	M	-	H	-	M	H	M	-	H	-	-	-
M	-	-	M	-	H	-	-	-	-	H	-	-	L	H
H	M	M	M	M	H	L	-	-	-	-	-	M	-	H
M	M	H	M	M	H	L	-	-	-	-	-	M	-	H
M	M	H	M	M	H	L	-	-	-	-	-	M	-	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	*Permutation and Combination – Introduction*	***Change of voice***	*Object Oriented Programming - Introduction*	***Overloading & Overriding** – Introduction*	***Time Complexity** – Introduction*
	SLO-2	*Permutation and Combination – Problems*	*Change of voice*	*Introduction to Monolithic, POP, Structures, OOP*	***Overloading & Overriding***	***Time Complexity***
S-2	SLO-1	*Probability – Introduction*	*Change of speech*	*Translators – Introduction*	***Virtual Functions & Abstract Class** – Introduction*	***Stacks & Queue - Applications***
	SLO-2	*Probability – Problems*	*Change of speech*	*Translators*	***Virtual Functions & Abstract Class***	***Stacks & Queue - Applications***
S-3	SLO-1	*Data Sufficiency – Introduction*	***Resume Writing - Introduction***	***Class** – Introduction*	***Dangling Pointer** – Introduction*	***Linked List & Operations** – Introduction*
	SLO-2	*Data Sufficiency – Problems*	***Resume Writing - Introduction***	***Class***	***Dangling Pointer***	***Linked List & Operations***
S-4	SLO-1	***Puzzles - Selections***	***Resume Writing - Session 1***	***Object Abstraction** – Introduction*	***Garbage Collector** – Introduction*	***Types of Trees & BST** – Introduction*

	SLO-2	***Puzzles - Selections***	***Resume Writing - Session 1***	***Object Encapsulation***	***Garbage Collector***	***Types of Trees & BST***
S-5	**SLO-1**	***Puzzles - Distribution***	***Types of Interviews - Group / Stress / HR***	*Polymorphism, Inheritance and Dynamics Binding – Introduction*	***Algorithm and Data Structures - Introduction***	***AVL Tree Operations*** *– Introduction*
	SLO-2	***Puzzles - Distribution***	***Types of Interviews - Group / Stress / HR***	*Polymorphism, Inheritance and Dynamics Binding*	***Logical Thinking & Arrays***	***AVL Tree Operations***
S-6	**SLO-1**	***Cubes & Cuboids***	***Presentations - Introduction***	*Function Execution Sequence - Introduction*	***Structures & Pointers*** *– Introduction*	***Introduction to P, NP, NP-Hard & NP-Complete Problems***
	SLO-2	***Cubes & Cuboids***	***Presentations - Activity***	*Stack & In Line Functions - Introduction*	***Structures & Pointers***	***Introduction to P, NP, NP-Hard & NP-Complete Problems***

Learning Resources	1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition 2. Scott Bennett, The Elements of Resume Style: Essential Rules for Writing Resumes and Cover Letters That Work, AMACOM, 2014 3. Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007	4. Greg Perry, Dean Miller, C Programming Absolute Beginne, Que Publishing, 3rd Edition 5. Cay S. Horstmann, Core Java Fundamentals, Volume 1, 11th Edition, Prentice Hall, 2018 6. Langsam, Augenstein, Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.

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%	30%
	Understand				
Level 2	Apply	50%	50%	40%	40%
	Analyze				
Level 3	Evaluate	40%	40%	30%	30%
	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**
Mr. M. Ponmurugan, Executive PMOSS, Cognizant Technology Solutions India Pvt. Limited, Chennai	*Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeedam, Coimbatore*	*Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST* *Dr. Muthu Deepa M, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST*

SEMESTER - IV

Course Code	UMA23108T	Course Name	Real Analysis	Course Category	C	*Discipline Specific Core Courses*	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	Employ various techniques for a detail analysis of real number system
CLR-2 :	Introduce the concept of metric space and the norm
CLR-3 :	Understand the role of continuous functions
CLR-4 :	Address the concept of derivatives
CLR-5 :	Introduce integration in real number system

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	PSO -1	PSO -2	PSO-3
CLO-1 :	Gain an insight on real and complex fields	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Be familiar with metric spaces and various kinds	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Classify the role of continuous functions and uniformly continuous functions	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Identify the extremities in various functions	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Characterize those functions which are Reimann-Stieltjes inegrable	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction- Review of N, W, Z, Q number systems	Function – definition; types	Limit of a function; Algebra of limits of function	Derivatives of elementary functions	Higher order derivatives
	SLO-2	Illustration of irrationals not belonging to Q	Injective, surjective and bijective functions – examples	Examples of algebra of limits of function	Differentiability leads to continuity	Leibniz formula
S-2	SLO-1	Solution for $p^2-2=0$ does not exist in Q	Finite, infinite, countable and uncountable sets	Continuous function; Composition of continuous functions	Sum, Product, Quotient rules	Taylor's theorem
	SLO-2	Illustration for $p^2-5=0$.	Illustrations, Every infinite subset of countable set is countable	Characterization for continuous functions; Examples	Illustrating with examples and counterexamples	Taylor's expansion of some functions
S-3	SLO-1	Ordered set; Cartesian product of sets; Law of trichotomy	Countable union of countable sets is countable	Algebra of continuous functions	Chain rule	Problems based on higher order derivatives
	SLO-2	Field axiom, unique factorization theorem for integers – statement only	Proof and consequences	Illustration of algebra of continuous functions	Application of chain rule	Solution to problems
S-4	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-5	**SLO-1**	Bounded above and bounded below, Least upper and greatest lower bounds	Q is countable	Bounded function	Maxima and minima	Partition of an interval
	SLO-2	Determining upper and lower bounds, LUB, GLB for R and secondary level sets	Set of infinite binary sequences is uncountable	Example and counterexample	First and second derivative tests	Example and properties
S-6	**SLO-1**	LUB property of R	Metric space – definition	Continuity and compactness	Generalized mean value theorem	Riemann integral of a function over an interval
	SLO-2	Application of LUB property	Examples- discrete metric and usual metric	Continuous image of a compact set is compact	Application to Mean value theorem	Definition – upper and lower Riemann integrals
S-7	**SLO-1**	Binary operations on a nonempty set; Field – ordered field	Open ball, closed ball, convex set; open and closed set, limit point, perfect and dense set, closure of set	Uniformly continuous function; Continuous function on a compact set is uniformly continuous	Lagrange's Mean value theorem	Function f is Riemann integrable
	SLO-2	Properties of ordered field	Examples and proof of balls are convex.	Continuous image of connected set is connected	Problems based on Mean value theorem	Examples and counterexamples
S-8	**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-9	**SLO-1**	Archimedian property of R	Every neighbourhood is open; Set is open iff its complement is closed; union and intersection of open and closed sets	Intermediate value theorem	Differentiability and Monotonicity	Riemannn Stieltjes integral
	SLO-2	Q is dense in R; Z is not dense in R	Open cover, subcover, finite subcover, compact set	Proof and illustration	Intermediate value theorem for derivatives	Riemann integral is special case of Riemann-Stieltjes integral
S-10	**SLO-1**	Existence of unique n^{th} root of positive real number	K is compact relative to X iff it compact relative to any compact subset of X.	Discontinuity of a function; Kind of discontinuities – examples	L'Hospital rule	Refinement, Common refinement
	SLO-2	Proof and illustration	Compact subsets of metric space are closed; closed subset of compact set is closed; some results on intervals	Monotonic functions – nature of discontinuities in monotonic functions	Proof and application	Necessary and sufficient condition for a function to be Reimann-Stieltjes inegrable
S-11	**SLO-1**	Extended R; Complex field	K-cell; Every k-cell is compact	Infinite limits and limits at infinity	Convex functions and differentiation	Continuous function on an interval is always Riemann Stieltjes integrable
	SLO-1	Properties	Heine-Borel theorem	Illustrating examples	Illustrating examples	If f is Riemann Stieltjes integrable and g is continuous, then their composition is Riemann Stieltjes integrable.
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

Learning Resources	1. Walter Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw–Hill Publications, Singapore, Reprint 2017. 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, 2020.	4. Royden, H.L., Real Analysis, 4th Edition, Pearson Education, India, 2015. 5. R. G. Bartle, D.R. Sherbert, Introduction to Real Analysis, 4th Edition, 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.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. A. Anuradha** anuradha@srmist.edu.in

Course Code	UMA23109T	Course Name	Numerical Analysis	Course Category	C	*Discipline Specific Core Courses*	L	T	P	O	C
							3	1	0	2	4

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 methodologies to solve algebraic and transcendental equations	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 :	Gain knowledge on interpolating and extrapolating methods in various intervals in real life																		
CLR-3 :	Understand the concept of numerical differentiation and integration																		
CLR-4 :	Acquire knowledge of various techniques and methods to solve initial and final value problems in differential equations																		
CLR-5 :	Understand the concept of numerical techniques for solutions of partial differential equations																		
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	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Apply interpolating and extrapolating methods	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-3 :	Compute numerical differentiation and integration	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-4 :	Interpret initial and final value problems in differential equations	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-5 :	Analyze the numerical solutions of partial differential equations	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
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 partial differential equations
	SLO-2	Algebraic and transcendental equations	Forward and backward differences	Newton's forward difference formula for derivatives	Single step methods	Finite difference and mesh points
S-2	**SLO-1**	A solution of numerical equation by Bisection method	Central difference	Newton's backward difference formula for derivatives	Taylor series method	Explicit scheme
	SLO-2	Bisection method	Relation between operators	Numerical differentiation Examples	Taylor series method	Crank-Nicholson scheme
S-3	**SLO-1**	A solution of numerical equation by Method of false position.	Newton's interpolation - Newton's forward interpolation for equal intervals	Numerical Integration	Euler's method	Solution of one dimensional parabolic equation by Explicit scheme
	SLO-2	False position method	Newton's forward interpolation for equal intervals	Trapezoidal rule	Euler's method	Examples

S-4	**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-5	**SLO-1**	A solution of numerical equation by Fixed point iteration method	Newton's backward interpolation for equal intervals	Simpson's one-third rule	Improved Euler's method	Solution of one dimensional parabolic equation by Crank-Nicholson scheme
	SLO-2	Iteration method	Newton's backward interpolation for equal intervals	Simpson's one-third rule	Improved Euler's method	Primitive Roots for Primes
S-6	**SLO-1**	A solution of numerical equation by Newton-Raphson method	Divided differences and Properties	Simpson's three-eighth rule	Modified Euler's method	Methodology for solving hyperbolic equation
	SLO-2	Newton-Raphson method	Interpolation with unequal intervals by Newton's divided difference	Simpson's three-eighth rule	Modified Euler's method	Solution of hyperbolic equation with finite difference scheme
S-7	**SLO-1**	Solving system of linear equation by Gauss Elimination method	Lagrange's interpolation formula for unequal intervals	Gaussian quadratures	Runge Kutta method of Second order	Examples with various boundary conditions
	SLO-2	Gauss Elimination method	Lagrange's interpolation formula for unequal intervals	Gaussian quadratures	Runge Kutta method of Second order	Examples with various boundary conditions
S-8	**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-9	**SLO-1**	Solving system of linear equation by Gauss Jacobi iterative method	Inverse interpolation– Lagrange's formula for inverse interpolation	Best Approximations - Least squares polynomial approximation	Runge Kutta method of fourth order	Diagonal and Standard five point finite difference formula
	SLO-2	Proof	solution	prime-power factorization	illustrative examples	plaintext
S-10	**SLO-1**	Solving system of linear equation by Gauss Seidal iterative method	Spline Interpolation	Approximation with Chebyshev polynomials	Multi step methods- Milne's method	Solution of elliptic equation using finite difference scheme
	SLO-2	Examples	proof	Properties of φ	Euler's Criterion	Knapsack Cryptosystem
S-11	**SLO-1**	Solving system of linear equation by Gauss Jacobi and Seidal iterative method	Cubic Spline interpolation	Piecewise Linear & Cubic Spline approximation	Adams Bashforth method	Examples on different regions with various boundary values
	SLO-1	Solving system of linear equation by Gauss Jacobi iterative method	Inverse interpolation– Lagrange's formula for inverse interpolation	Best Approximations - Least squares polynomial approximation	Runge Kutta method of fourth order	Diagonal and Standard five point finite difference formula
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

Learning Resources	1. Jain M.K, "Numerical Methods for Scientific and Engineering computation", 3rd Edition, New Age International, 1999. 2. Conte S.D. and Carl de Boor, "Elementary Numerical Analysis", 3rd Edn, Tata McGraw-Hill Publishing. 2004.	3. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson. 4. F. B. Hildebrand (2013). Introduction to Numerical Analysis: (2nd edition). Dover Publications. 5. Balagurusamy. E, Numerical Methods, Tata McGraw Hill Publishing Company, 3rd Edition, 2000.

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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Course Code	UMA23110T	Course Name	Abstract Algebra	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	To understand groups and will be able to study about its properties.
CLR-2 :	To understand the concepts of Centre of groups, Sylow subgroups and simple groups.
CLR-3 :	*Gain knowledge about rings and ideals.*
CLR-4 :	*Gain knowledge Euclidean ring and polynomial rings*
CLR-5 :	*Gain knowledge field extension*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	Recognize the mathematical objects called groups	4	85	80	H	-	-	-	M	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Derive and solve Sylow's theorem and their applications	4	85	80	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply the fundamental concepts in ring theory such as ideals, commutative rings and principal ideal domains.	4	85	80	H	-	-	-	M	-	-	-	-	-	-	H	-	-	-
CLO-4 :	Learn about Euclidean ring, polynomial ring and properties of polynomial ouver rational field	4	85	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Derive solutions in cryptography and real life problem	4	85	80	-	H	-	-	H	-	H	-	-	-	-	H	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Groups	Conjugacy relation	Rings and Fields with Examples	Euclidean ring with example	Field extension
	SLO-2	Examples	Conjugacy relation is equivalence relations	Properties of Rings	Properties of Euclidean ring	Examples

S-2	**SLO-1**	Properties	Definition of N(a) with example	Properties of Rings	Properties of Euclidean ring	Towers theorem
	SLO-2	Types of groups	Center of a group with example	Ideals	Unique Factorization Theorem	Towers theorem
S-3	**SLO-1**	Abelian groups	Relation between N(a) and Z(G)	Quotient rings	Relation between Euclidean ring and PID	Towers Theorem
	SLO-2	Cyclic groups, Permutation groups, Practice and Subgroups	Class equation and its properties	Homomorphism and Isomorphism on Rings and Prime ideal	Euclidean ring, PID and Relation between Euclidean ring and PID	Algebraic element and Properties of algebraic elements
S-4	**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-5	**SLO-1**	Subgroups, Necessary and sufficient condition for subgroups	Application of Class equations	Maximal ideal and Minimal ideal	Polynomial rings with example	Characterization of F(a)
	SLO-2	Subgroups, Necessary and sufficient condition for subgroups	Application of Class equations	Maximal ideal and Minimal ideal	Polynomial rings with example	Characterization of F(a)
S-6	**SLO-1**	Normal Subgroup and examples	Problems on Class equations	Integral Domain with example	More about polynomial ring	Relation between F(a) and algebraic element
	SLO-2	Left and right cosets	Examples	Properties of Integral Domain	Proof of Polynomial ring is an Euclidean ring	Relation between F(a) and algebraic element
S-7	**SLO-1**	Quotient group	Cauchy theorem for-abelian groups with examples	Principal Ideal Domain with example	Division Algorithms	Algebraic extension
	SLO-2	Examples of Quotient group	Cauchy theorem for abelian groups with examples	Properties of PID's and Problems in PID	Polynomial over rational field and Examples of rational fields	Properties of algebraic extension
S-8	**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-9	**SLO-1**	Problems in Quotient group	Problems in Cauchys theorem for non abelian groups	Problems in Principle Ideal	Problems in Polynomials in rational fields	Examples of algebraic extension
	SLO-2	Problems in Quotient group	Problems in Cauchys theorem for non abelian groups	Problems in Principle Ideal	Problems in Polynomials in rational fields	Examples of algebraic extension
S-10	**SLO-1**	Group Homomorphism and isomorphism	Sylow – 1 Theorem	Reducible, irreducible and prime elements	Polynomial over rational field	Roots of polynomial
	SLO-2	Group Homomorphism and isomorphism	Sylow – 1 Theorem	Reducible, irreducible and prime elements	Polynomial over rational field	Roots of polynomial
S-11	**SLO-1**	Isomorphism theorem	Sylow -2 Theorem	Unique Factorization Domain with example	Gauss Lemma	Splitting field
	SLO-2	Lagrange Theorem and Cayley's Theorem	Sylow – 3 Theorem	Properties of of UID's	Eisenstein Criterion	Properties of splitting 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

Learning Resources	1. J.A. Gallian, Contemporary Abstract Algebra, Narosa, 4th Ed., 1999 2. I. N. Herstein, Topics in Algebra, John-Wiley, 1995 3. M. Artin, Algebra, Prentice Hall Inc., 1994.	**4.** D. S. Dummit and R. M. Foote, Abstract Algebra, John-Wiley, 2nd Ed., 1999. 5. J. B. Fraleigh,A First Course in Abstract Algebra, Pearson, 7thEd., 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	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. MadhanShanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. E. Nandakumar, SRMIST** nandakue@srmist.edu.in

Course Code	ULT23AE2J	Course Name	Applied Tamil – II	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	அகராதி, கலைச்சொல் குறித்த நுட்பங்களை அறியச் செய்தல்			
CLR-2 :	நேர்காணல் செய்யும் திறனும் செய்தி வாசிப்பு முறைகளையும் தெரியச் செய்தல்			
CLR-3 :	விமர்சனத்தின் தன்மைகளும் செய்தியறிக்கை தயாரிக்கும் முறையையும் அறியச் செய்தல்			
CLR-4 :	பேச்சுக்கலையின் தனித்துவங்களைப் புரியச் செய்தல்			
CLR-5 :	கணினித்தமிழின் பல்வேறு நுட்பங்களைத் தெரியச் செய்தல்			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	அகராதித்துறை, கலைச்சொல்லாக்கத் துறையைத் தெரிந்துகொள்ளுதல்	2	75	60
CLO-2 :	ஊடகங்களில் மொழி ஆளுமையோடு செயல்படும் திறன் பெறுதல்	2	80	70
CLO-3 :	கலை, இலக்கிய விமர்சன முறைகளையும், செய்தியறிக்கை தயாரிக்கும் நுட்பங்களையும் தெரிந்துகொள்ளுதல்	2	70	65
CLO-4 :	பல்வேறு வடிவங்களைக் கொண்ட பேச்சுக்கலையை அறிவதன்வழி, சிறந்த மேடைப் பேச்சாளராக உருவாகும் தகுதியைப் பெறுதல்	2	70	70
CLO-5 :	தமிழைக் கணினி வழி, இணையம் வழி கொண்டுசேர்க்கும் உலகளாவிய செயல்பாடுகளை அறிந்துகொள்ளுதல்	2	80	70

Program Learning Outcomes (PLO)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	H	L	H	M	H	H	L	M	H	M	L	H	-	-	-
CLO-2 :	H	M	H	L	M	H	L	H	M	L	H	H	-	-	-
CLO-3 :	H	L	H	M	H	H	M	H	L	H	M	H	-	-	-
CLO-4 :	H	M	H	L	H	M	M	H	H	L	H	H	-	-	-
CLO-5 :	H	M	H	H	M	H	L	M	H	L	H	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	தமிழில் அகராதிகள்	நேர்காணல் அறிமுகம்	**விமர்சனம் – அறிமுகம்**	**பேச்சுக்கலை**	**கணினித்தமிழ்**
	SLO-2	ஒரு மொழி இருமொழி அகராதி	ஆளுமைத்திறன்	விமர்சனத்தின் நோக்கம்	பேச்சின் அடிப்படைகள்	கணினி வழித் தட்டச்சு
S-2	SLO-1	பன்மொழி அகராதி	நோக்கம் – கண்டறிதல்	**விமர்சன வகைகள்**	தன்னம்பிக்கையும் பேச்சும்	**தட்டச்சு செய்யும் மென்பொருட்கள்**
	SLO-2	உயிர்/ மெய் எழுத்துகள்	நேர்காணல் முறைகள்	**இலக்கிய விமர்சனம்**	**பேச்சின் வகைகள்**	**எழுத்துருக்கள்**

S-3	SLO-1	உயிர்மெய் எழுத்துகள்	இனிய சொற்கள் பயன்பாடு	**திரை விமர்சனம்**	மேடைப் பேச்சு	**யூனிகோடு எழுத்துருக்கள்/ பிற எழுத்துருக்கள்**
	SLO-2	அகராதிக்கான அடிப்படைகள்	நேர்காணல் வகைகள்	கலை விமர்சனம்	**பட்டிமன்றப் பேச்சு**	**குரல் வழி தட்டச்சு**
S-4	SLO-1	அகராதி உருவாக்கப் பயிற்சி	நேரடியாக வினா விடை	**விமர்சகர் தகுதிகள்**	**சொற்பொழிவு முறை**	**எழுத்து வழி தட்டச்சு**
	SLO-2	அகராதி உருவாக்கப் பயிற்சி	**அச்சு ஊடக நேர்காணல்**	தேர்ந்த புலமை	பேச்சின் நுட்பங்கள்	தட்டச்சு செய்யும் பயிற்சி
S-5	SLO-1	கலைச்சொல் அறிமுகம்	**காட்சி ஊடக நேர்காணல்**	**எழுத்துவடிவ விமர்சனம்**	பேச்சாளர்களும் பேசும் முறைகளும்	தட்டச்சு செய்யும் பயிற்சி
	SLO-2	பிறமொழிச் சொற்களும் தமிழில் கலைச் சொற்களும்	**கேட்பு ஊடக நேர்காணல்**	**காட்சி வடிவ விமர்சனம்**	பேச்சு - எடுத்துரைப்பும் உடல்மொழியும்	**பிழை திருத்திகள்**
S-6	SLO-1	கலைச்சொல்லாக்க நெறிமுறைகள்	கள ஆய்வில் நேர்காணல்	விமர்சனம் செய்யும் பயிற்சி	நவீன தொழில்நுட்பங்களில் பேச்சு முறைகள்	தமிழில் பிழை திருத்தம் செய்யும் மென்பொருட்கள்
	SLO-2	கலைச்சொல் உருவாக்க உத்திகள்	நேர்காணல் செய்யும் பயிற்சி	விமர்சனம் செய்யும் பயிற்சி	**பேச்சாளர்க்குரிய தகுதிகள்**	**வலைப்பூ உருவாக்கம்**
S-7	SLO-1	துறைசார் சொற்கள்	நேர்காணல் செய்யும் பயிற்சி	**செய்தியறிக்கை**	**பேச்சுப் பயிற்சி**	வலைப்பூவில் எழுதும் முறைகள்
	SLO-2	புதிய கண்டுபிடிப்புகளும் கலைச்சொற்களும்	**செய்தி வாசிப்பு முறைகள்**	சமூக நிகழ்வை எழுதுதல்	**பேச்சுப் பயிற்சி**	வலைப்பூவின் பயன்கள்
S-8	SLO-1	பயன்பாட்டுச் சொற்கள்	**செய்தி வாசிப்பு நுட்பங்கள்**	**செய்தியாளர்க்குரிய தகுதிகள்**	கலந்துரையாடலின் நோக்கம்	**தமிழ் இணைய நூலகங்கள்**
	SLO-2	கலைச்சொல்லாக்கப் பயன்பாடுகள்	உச்சரித்தல்	உற்றுநோக்குதல்	**கலந்துரையாடலின் தனித்தன்மைகள்**	இணைய நூலகப் பயன்பாடுகள்
S-9	SLO-1	கலைச்சொல் உருவாக்கப் பயிற்சி	பிழையின்றி வாசித்தல்	சமநிலையில் எழுதுதல்	தம் கருத்தைத் தெளிவாக உரைத்தல்	தமிழ்த் தொடரடைவுகள்
	SLO-2	கலைச்சொல் உருவாக்கப் பயிற்சி	வாசித்தலும் உணர்வும்	**செய்தியறிக்கை தயாரித்தல்**	கலந்துரையாடல் பயிற்சி	**தொடரடைவின் பயன்பாடுகள்**

Learning Resources	1. அகராதியியல், பெ. மாதையன், தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர், 1997. 2. பேச்சுக்கலை, ம. திருமலை, மீனாட்சி புத்தக நிலையம், மயூராவளாகம், மதுரை, 2009. 3. பேச்சாளராக, அ.கி.பரந்தாமனார், பாரி நிலையம், சென்னை, 1961 4. இணையத் தமிழ், சந்திரிகா சுப்பிரமணியன், சந்திரோதயம் பதிப்பகம், மதுரை, 2020. 5. நேர்காணல், மின்னூலகம், தமிழ் இணையக் கல்விக் கழகம், https://www.tamilvu.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%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. P.R.Subramanian, Director, Mozhi Trust, Thiruvanmiyur, Chennai – 600 041.	*1. Dr. V. Dhanalakshmi, Associate Professor, Subramania Bharathi School of Tamil Language & Literaturel, Pondicherry University, Pondicherry*	*1. Dr. B.Jaiganesh, Associate Professor & Head, Dept. of Tamil, FSH, SRMIST, KTR*
		2. Dr. R. Ravi, Assistant Professor and Head, Dept. of Tamil, FSH, SRMIST, VDP.
		3. Mr. G. Ganesh, Assistant Professor, Dept. of Tamil, FSH, SRMIST, RMP.
		4. Dr. T.R.Hebzibah beulah Suganthi, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.
		5. Dr. S.Saraswathy, Assistant Professor, Dept. of Tamil, FSH, SRMIST, KTR.

Course Code	ULH23AE2J	Course Name	APPLIED HINDI-II	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To find and analyze different types of Cinema			
CLR-2 :	To Discover the print Media in the present World			
CLR-3 :	Writing report for Employability			
CLR-4 :	Writing Reviews and Create Job Oriented learning			
CLR-5 :	To Acquire technical words for various job Prospects			

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	PSO -1	PSO -2	PSO-3
CLO-1 :	To Understand the History and Documentary in Hindi Cinema	2	75	80	H	H	H	M	L	H	L	M	L	L	H	M	-	-	-
CLO-2 :	To Comprehend Media Studies	2	80	90	H	H	H	M	L	H	H	M	L	L	H	M	-	-	-
CLO-3 :	To Evaluate report Writing	2	75	95	H	H	M	L	H	H	M	H	M	M	H	H	-	-	-
CLO-4 :	Enhance their Writing Skills in Media Studies	2	80	90	H	H	L	H	M	H	L	H	H	M	H	H	-	-	-
CLO-5 :	To Understand and usage of technical words in Hindi	2	85	90	M	H	M	H	L	H	H	L	H	M	H	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	HINDI CINEMA	MEDIA AUR HINDI BHASHA	REPORTARJ LEKHAN	FILM REVIEW& VIGYAPAN	PARIBHASHIK SHABDAVALI
	SLO-2	CINEMA KI AVDHARNA	AVDHARNA	AVDHARNA	ARTH	RTH
S-2	SLO-1	UDBHAV	SWARUP	SWARUP	PARIBHASHA	ARIBHASHA
	SLO-2	VIKASH	MAHATVA	DDESHYA	WARUP	WARUP
S-3	SLO-1	DOCUMENTRI MOVE KI AVDHARNA	MEDIA MEN BHASHA KA PRAYOG	AHATVA	AWADHARNA	RAKAR
	SLO-2	COMERCIAL MOVE KI AVDHARNA	UTTARDAYITVA	REPORTARJ LEKHAN KE PRATI RUCHI JAGANA	FILM REVIEW KA MAHATTVA	VADHARNA
S-4	SLO-1	PRAYOJAN	PRINT MEDIA	REPORTAJ KI BHUMIKA	VIGYAPAN AUR BAZAR	RAYOJAN
	SLO-2	UDDESHYA	ELECTRONIC MEDIA	PRAYOJAN	VIGYAPAN AUR ROZGAR	DDESHYA
S-5	SLO-1	MAHATVA	MEDIA KI JIMMEDARI	PRAYOG	PRINT VIGYAPAN	AHATVA
	SLO-2	PRAKAR	SMACHAR LEKHAN	UTTARDAYITVA	VIGYAPAN KI BHASHA	RAYOG
S-6	SLO-1	PRISHTHBHUMI	REPORTER KE GUN	RIPOTARJ LEKHAN	AWADHARNA	DDESHYA

	SLO-2	KARYASHALA	SAHAJTA	PUNRIKSHAN	ARTH	AKANIKI SHABDAVALI KA MHATVA
S-7	SLO-1	DOCUMENTRY KI VIDHI	NISPAKSHTA	LEKHAN VIDHI	PARIBHASHA	HINDI SE ANGREZI SHABD
	SLO-2	DOCUMENTRY AUR COMERCIAL MOVE MEN ANTAR	PEET PATRAKARITA	SAMAJIK DAYRA	SWARUP	ANGREZI SE HINDI SHABD
S-8	SLO-1	COMERCIAL KI VIDHI	UTTARDAYITVA	SAHITYA ME RIPOTARJ LEKHAN	VIGYAPAN KE PRAKAR	EK DIN EK SHABD
	SLO-2	MOVE VISLESHAN	BHASHA GYAN	PARIYOJNA KARYA	VIGYAPAN KI VISHESHTAYEN	SHABDON KA VISLESHAN
S-9	SLO-1	PARICHARCHA	PARICHARCHA	PARICHARCHA	VIGYAPAN MANG	PATH PRICHARCHA
	SLO-2	PRASHNABHYASH	PRASHNABHYASH	PRASHNABHYASH	VIGYAPAN KA PRABHAV	PRASHNABHAYASH

Learning Resources	***Edited Book: "PRAYOJAN MULOK HINDI", SRIJONLOK PUBLICATION, 2023, New Delhi.*** 1. Film Banti Hai aur Banati Bhi hai, Lekhika – Sonal, Neolit Publication 2. https://navbharattimes.indiatimes.com/entertainment/movie-review/articlelist/2325387.cms?curpg=3 3. https://epustakalay.com/book/4858-hindi-patrakarita-by-dr-krishnbihari-mishra/ 4. https://hindisamay.com/ 5. https://rajbhasha.gov.in/hi/hindi-vocabulary

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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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	**Experts from Higher Technical Institutions**	**Internal Experts**
Shri. Santosh Kumar Editor : Srijanlok Magazine Place: Vashishth Nagar, Ara – 802301	*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
		4, Dr.Nisha Murlidharan Assistant Professor, VDP,SRM IST

Course Code	ULF23AE2J	Course Name	French for Specific purpose-II	Course Category	AE	Ability Enhancement Courses (AE)	L	T	P	O	C
							1	0	2	2	2

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:
CLR-1 :	Strengthen the language of the students both in oral and written
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

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	PO 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 :	o enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	2	75	80	H	M	H	H	M	H	H	L	M	M	H	L	-	-	-
CLO-2 :	To strengthen the knowledge on concept, culture, civilization and translation of French	2	80	90	M	H	L	H	H	M	H	M	L	L	H	M	-	-	-
CLO-3 :	To develop content using the features in French language	2	75	80	H	H	L	M	H	M	L	H	M	M	H	H	-	-	-
CLO-4 :	To interpret the French language into other language	2	75	90	H	L	M	H	M	H	H	M	L	H	M	L	-	-	-
CLO-5 :	To improve the communication, intercultural elements in French language	2	80	75	M	H	H	L	M	M	H	H	M	L	H	M	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	TOEIC	Les quantificateurs	Les prépositions de lieu	Les verbes irréguliers	La négation
	SLO-2	Qu'est-ce que c'est/	le génitif	Les activités	le futur et	l'interrogation
S-2	SLO-1	À qui est-il destiné ?	Les adjectifs	Les prépositions de temps -	le conditionnel	Les activités
	SLO-2	Les compétences évaluées	et pronoms possessifs	Les activités	les modaux	l'exclamation
S-3	SLO-1	Le nom	les pronoms	les temps et	La suggestion	Les activités
	SLO-2	Le pluriel des noms	Les pronoms personnels	Les activités	le conseil	l'emphase
S-4	SLO-1	Les indénombrables	les pronoms compléments	les aspects-	Les exemples	Les exemples
	SLO-2	Les noms composés	Les activités	Les activités	le reproche	Les activités
S-5	SLO-1	L'adjectif	pronoms réfléchis	Le présent simple	Les activités	l'impératif
	SLO-2	Les comparatifs	Les activités	Les activités	L'obligation	Les activités
S-6	SLO-1	les superlatifs	les adverbes	Le présent be+ing	la permission	la voix passive
	SLO-2	les articles définis (the)	Les activités	Les activités	l'interdiction	Les exemples
S-7	SLO-1	les articles indéfinis (a, an)	La place de l'adverbe dans la phrase	*Les exemples*	La capacité	les subordonnées relatives

	SLO-2	Les exemples	Les activités	Le prétérit simple - Le prétérit be+ V-ing	l'incapacité	Les activités
S-8	**SLO-1**	Les adjectifs	L'ordre des adverbes	Les exemples	les verbes à particule	Les subordonnées circonstancielles
	SLO-2	Les exemples	Les activités	- Le présent perfect be+ing	les verbes suivis de V-ing	Les activités
S-9	**SLO-1**	pronoms possessifs (this et that)	les prépositions-	Le past perfect simple -	d'un infinitif avec sans to	A ne pas confondre
	SLO-2	Les activités	Les exemples	Le past perfect be + ving -	Les exemples	Les activités

Learning Resources	***Theory:*** 1. ***"Réussir le noueau TOEIC"*** Détails des épreuves, méthodologie, grammaire, et vocabulaire, Studyrama. ***2.*** *https://www.fluentu.com/blog/french/french-grammar* ***3.*** *https://www.elearningfrench.com/learn-french-grammar-online-free.html* ***4.*** *https://www.lawlessfrench.com/grammar* ***5.*** *https://blog.gymglish.com/2022/12/15/basic-french-grammar*

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 (5%)#**			
		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%	50%	50%	40%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	20%	20%	30%	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. Mr. Kavaskar Danasegarane Process Expert Maersk Global Service Center Pvt. Ltd	*1. Dr. C.Thirumurugan Professor, Department of French, Pondicherry University*	*1. Mr. Kumaravel K. Assistant Professor & Head, SRMIST, KTR*
2.Mr. Sharath Raam Prasad Character Designer, Animaker Company Pvt.		*2. Mrs. Abigail, Assistant Professor, SRMIST, VDP*

Course Code	UMA23G01T	Course Name	Sampling theory	Course Category	G	Generic Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	To learn the concept of sampling techniques	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 apply the sampling techniques for Mathematical problems																		
CLR-3 :	To learn the type of sampling																		
CLR-4 :	To estimate mean and its sampling variance																		
CLR-5 :	To learn the role of sampling theory in life																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Know the concept of sampling techniques	4	85	80	H	-	-	-	-	-	-	-	-	-	-	H	-	-	-
CLO-2 :	How to apply the sampling techniques for Mathematical problems	4	85	80	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Know the types of sampling meathods in life	4	85	80	H	-	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-4 :	How to estimate mean and its variance in sampling theory	4	85	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Know the role of sampling theory in life	4	85	80	-	H	-	-	-	-	H	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Basic concepts and Fundamentals	Simple random sampling	Systematic random sampling - Introduction	Cluster Sampling - Introduction	Double Sampling-Introduction
	SLO-2	Basic concepts and Fundamentals	Simple random sampling	Systematic random sampling - Introduction	Cluster Sampling - Introduction	Derivation of Mean and Variance in Double Sampling
S-2	SLO-1	Population - Census - Sample	Selection of a simple random sample	Advantages of systematic sampling	Equal cluster sampling	Double Sampling in Ratio Method of Estimation
	SLO-2	Representative sample -Sampling frame	Selection of a simple random sample	Advantages of systematic sampling	Estimation of mean and its Variance	Bias and MSE under Double Sampling in Ratio Method of Estimation
S-3	SLO-1	Advantages of the sampling method: Reduced cost, Greater speed	Estimation of population mean and variance	Estimation of mean and its sampling variance	Estimation of mean and its Variance	Comparison with Simple Random Sampling
	SLO-2	Advantages of the sampling method: Reduced cost, Greater speed	Estimation of population mean and variance	Estimation of mean and its sampling variance	Estimation of mean and its Variance	Comparison with Simple Random Sampling
S-4	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-5	**SLO-1**	Advantages of the sampling method: Greater scope, Greater accuracy	Estimation of variance from a sample	Estimation of mean and its sampling variance	Estimation of relative efficiency	Comparison with Simple Random Sampling
	SLO-2	Advantages of the sampling method: Greater scope, Greater accuracy	Estimation of variance from a sample	Estimation of the variance	Estimation of a proportion in case of equal and unequal clusters	Comparison with Simple Random Sampling
S-6	**SLO-1**	Some Uses of Sample Surveys	Estimation of standard errors from a sample	Comparison of systematic sampling with SRS and stratified sampling	Estimation of a proportion in case of equal and unequal clusters	Comparison with Simple Random Sampling
	SLO-2	Some Uses of Sample Surveys	Estimation of standard errors from a sample	Comparison of systematic sampling with SRS and stratified sampling	Estimation of a proportion in case of equal and unequal clusters	Estimation by regression method - Estimation error
S-7	**SLO-1**	Principal steps in a sample survey	Confidence limits for the population mean	Concept of ratio estimator	Two stage sampling (Subsampling) with equal first stage units	Bias and MSE of regression estimator
	SLO-2	Principal steps in a sample survey	Confidence limits for the population mean	Concept of ratio estimator	Two stage sampling (Subsampling) with equal first stage units	Bias and MSE of regression estimator
S-8	**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-9	**SLO-1**	Principal steps in a sample survey	Stratified Sampling: Introduction, Notations and Properties of the estimates	Concept of regression estimator	Estimation of population mean, Bias and Variance	Bias and MSE of regression estimator
	SLO-2	Principal steps in a sample survey	Stratified Sampling: Introduction, Notations and Properties of the estimates	Concept of regression estimator	Estimation of population mean, Bias and Variance	Bias and MSE of regression estimator
S-10	**SLO-1**	Role of sampling theory	Estimation of variance and confidence limits	Concept of regression estimator	Estimation of population mean, Bias and Variance	Double sampling for probability proportional to size estimation
	SLO-2	Role of sampling theory	Estimation of variance and confidence limits	Concept of regression estimator	Estimation of population mean, Bias and Variance	Double sampling for probability proportional to size estimation
S-11	**SLO-1**	Role of sampling theory	Optimum allocation	Concept of regression estimator	Estimation of population mean, Bias and Variance	Double sampling for probability proportional to size estimation
	SLO-2	Role of sampling theory	Optimum allocation	Concept of regression estimator	Estimation of population mean, Bias and Variance	Double sampling for probability proportional to size estimation
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

Learning Resources

1. Cochran, W. G. (1977). Sampling techniques (3rd ed.). John Wiley & Sons, New York.
2. Mukhopadhyay, P. (1998). Theory and methods of survey sampling (2nd ed.). PHI Learning Pvt. Ltd., New Delhi.
3. Rao, P.S.R.S. (2000). Sampling Methodologies with Applications (1st ed.). Chapman and Hall/CRC.
4. Sukhatme, P. V., Sukhatme, B. V. (1970). Sampling theory of survey with applications (2nd ed.). Iowa State University Press.
5. Thompson, Steven K. (2012) Sampling, 3rd Edition. John Wiley and Sons. ISBN-13: 978-0470402313

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
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Course Code	UMA23G02T	Course Name	*Data Base Management System*	Course Category	G	*General Elective Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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:
CLR-1 :	*To study the concepts of Relational Database design and query languages.*
CLR-2 :	*To provide a general introduction to Relational model*
CLR-3 :	*To learn about ER diagrams*
CLR-4 :	*To learn about Query processing and Transaction Processing*
CLR-5 :	*To learn the normalization a given database schema.*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*Describe the features of database management systems.*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Differentiate between database systems and file systems.*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Models an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.*	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Write queries in relational algebra / SQL.*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Normalize a given database schema.*	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to database.	Secondary storage Devices.	Relational algebra: introduction.	SQL: data definition	Issues for Resilient Operation Undo/Redo Logging
	SLO-2	File systems versus Database systems	RAID Technology.	Selection and projection.	Simple Queries in SQL	Models for Resilient Operation Undo/Redo Logging
S-2	SLO-1	The Evolution of Database Systems	File operations	Set operations.	Sub queries	Protecting against Media Failures.
	SLO-2	Data Models, DBMS Architecture	Hashing Techniques, Indexing	Renaming, Joins.	Complex SQL Queries	Protecting against Concurrency Control, Serial
S-3	SLO-1	Transaction management	Single level and Multi-level Indexes	Division., Syntax, semantics.	Null Values, Nested sub queries	Serializable Schedules
	SLO-2	Transaction management	Single level and Multi-level Indexes	Division., Syntax, semantics.	Null Values, Nested sub queries	Serializable Schedules
S-4	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-5	SLO-1	Data Independence	B+ tree	Operators.	Full-Relation Operations	Conflict Serializability

	SLO-2	Data Independence	B+ tree	Operators.	Full-Relation Operations	Conflict Serializability
S-6	SLO-1	Entity-Relationship (E/R) Data Model	Indexes on Multiple Keys	Grouping and ungrouping.	Database Modifications-Defining a Relation Schema	Enforcing serializability by Locks
	SLO-2	Elements of the E/R Model	RAID 0	Relational comparison.	View Definitions	Locking Systems With Several Lock Modes
S-7	SLO-1	Entity – Relationship Diagrams	Fixed Length Records	Calculus: Introduction.	Constraints and Triggers: Keys and Foreign Keys	Concurrency Control by Timestamps
	SLO-2	Design Principles	Variable Length Records	Tuple relational calculus.	Constraints on Attributes and Tuples, Modification of Constraints	Concurrency Control by Validation
S-8	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-9	SLO-1	The Modeling of Constraints	Hardware Issues	Domain relational Calculus.	Schema-Level Constraints and Triggers	View serializability
	SLO-2	The Modeling of Constraints	Hardware Issues	Domain relational Calculus.	Schema-Level Constraints and Triggers	View serializability
S-10	SLO-1	Weak Entity Sets	Static Hashing	Calculus vs algebra.	Java Database Connectivity	Resolving Deadlocks
	SLO-2	Weak Entity Sets	Static Hashing	Calculus vs algebra.	Java Database Connectivity	Resolving Deadlocks
S-11	SLO-1	Enhanced E-R Modeling	Handling Bucket Overflows	Computational capabilities.	Security and User Authorization in SQL	Distributed Databases, commit& lock
	SLO-2	Enhanced E-R Modeling	Handling Bucket Overflows	Computational capabilities.	Security and User Authorization in SQL	Distributed Databases, commit& lock
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

Learning Resources	1. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book" - Pearson Education, 2002. 2. A Silberschatz, H Korth, S Sudarshan, “Database System and Concepts”,fifth EditionMcGraw-Hill	3. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2011), Database System Concepts. 6th edition. Tata McGraw-Hill Education. 4. Rob, Coronel, “Database Systems”,Seventh Edition, Cengage Learning.

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. Tapas Barman,** **tapasb@srmist.edu.in**

Course Code	UMA23S02J	Course Name	Python Programming	Course Category	S	Skill Enhancement Course	L	T	P	O	C
							1	0	2	2	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:
CLR-1 :	Understanding the python language construct and apply them for scientific computation
CLR-2 :	Apply python vector, list and plot concept to solve curve fitting
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

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	PSO -1	PSO -2	PSO-3
CLO-1 :	Apply python language construct to compute formula and scientific problem	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Analyze Mathematical Models system using f Difference Equations and solving	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply time sequence concept for generation and processing of audio signal by python	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Apply python language construct to solve Polynomials	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply python language construct to compute probability by Monte Carlo Simulation, game design and dynamic random motion creation	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (9)	Module-II (9)	Module-III (9)	Module-IV (9)	Module- V (9)
S 1	SLO-1	Python 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	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 2-3	SLO-1 SLO-2	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
S 4	SLO-1	Complex Numbers, Complex Arithmetic 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 5-6	**SLO-1** **SLO-2**	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
S 7	**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 8-9	**SLO-1** **SLO-2**	Lab 3: Programming on list and loops	Lab 6: Sound generated by formula and difference equation	Lab 9: Programming on classes	Lab 12: Random Walk in One Space Dimension or Two Space Dimensions	Lab 15: Numpy usage

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. 4. Cric Matthes, Python crash course, 2nd edition, 2019. 5. Paal Barry, Elements of programming interviews, 2022

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%	30%	30%	30%	30%	30%
	Understand										
Level 2	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
	Analyze										
Level 3	Evaluate	20%	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
Mr. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in **2. Dr. B. V. Rathish Kumar, IIT Kanpur** bvrk@iitk.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in **2.Dr. S. Athithan** athithas@srmist.edu.in

Course Code	UCD23V05T	Course Name	Career Readiness and Professional Skills	Course Category	V	Value Addition Course	L	T	P	O	C
							2	0	0	2	2

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Enable students to understand reasoning skills and mathematical concepts
CLR-2 :	Prepare students for job interviews
CLR-3 :	Learn structured query language (SQL) to an intermediate/advanced level
CLR-4 :	Learn the benefits of Python as a scripting language
CLR-5 :	Develop life-long skills students can use to seek jobs, internships and make career changes

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 :	Solve the problems on reasoning	3	80	75	H	M	-	-	-	M	-	H	-	H	-	H	M	-	-
CLO-2 :	Face interviews confidently	3	80	75	-	-	M	-	M	-	-	-	L	-	H	-	-	H	H
CLO-3 :	Understand the importance and major issues of database security and the maintenance of data integrity	3	75	70	H	M	-	M	H	-	M	-	-	-	-	M	-	H	M
CLO-4 :	Utilise essential programming components including variables, conditional logic, loops, and functions to create simple programs	3	75	70	H	-	M	M	-	H	-	-	-	M	-	H	-	H	M
CLO-5 :	Assist students in choosing a career path during their course	3	75	70	-	M	M	-	H	-	M	-	-	-	H	-	-	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Partnership	Self-Image and Self-Presentation	SQL - Introduction to SQL	SQL – Joins	Class coding basics
	SLO-2	Partnership related solving problems	Etiquettes	SQL Statement Classes	SQL – inner joins –Join Syntax	Class coding basics – quiz session
S-2	SLO-1	Cryptarithmetic	Interview Skills - Introduction	Introduction to Databases	Introducing Python	Understanding Data Structures
	SLO-2	Cryptarithmetic – solving problems	Do's and Don'ts during Interview	SQL - Databases & RDBMS	Introducing Python Object Types	Python for Data
S-3	SLO-1	Ordering, Ranking	Mock Interview – Session 1	SQL data types - Introduction	Python - Data Types & Operators	Python Data Types
	SLO-2	Grouping	Mock Interview – Session 2	SQL data types	Python's Core Data Types	Overview of Python Data Types
S-4	SLO-1	Venn Diagrams concepts	Mock Interview – Session 3	SQL - Syntax	Introduction to Functions	Python Structures
	SLO-2	Venn Diagrams solved questions	Mock Interview – Session 4	SQL – Data Type Syntax	Why use Functions	Overview of Python Data Structures
S-5	SLO-1	Types of Paragraph	HR Round – Practice Session	SQL – Commands Introduction	Python – Functions basic	Python - Collections

	SLO-2	*Paragraph Forming Questions*	*HR personal Interview –Mock-Session*	*SQL - DDL, DML Commands*	*Coding functions*	*Improving Code readability*
S-6	***SLO-1***	*Types of Sentences*	*Email Etiquettes*	*SQL - Subqueries*	*Introduction to Classes*	*Collection Module*
	SLO-2	*Ordering of Sentences*	*Email Drafting – Do's and Don'ts*	*Non-correlated Subqueries*	*Why Use Classes?*	*Collection Module in Python*

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. *Edgar Thrope, Test of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition*	4. *Bhatnagar R P, English for Competitive Examinations, Trinity Press, 2016* 5. *C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.* 6. *Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.*

Learning Assessment					
Level	Bloom'sLevel 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	20%	10%	25%	25%
	Understand				
Level 2	Apply	50%	50%	50%	50%
	Analyze				
Level 3	Evaluate	30%	40%	25%	25%
	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, e

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**
Mr. M. Ponmurugan, Executive PMOSS, Cognizant Technology Solutions India Pvt. Limited, Chennai	*Dr. G. Saravana Prabu, Asst. Professor, Department of English, Amrita Vishwa Vidhyapeedam, Coimbatore*	*Dr. Sathish K, HOD, Department of Career Guidance Cell, FSH, SRMIST* *Ms. Deepalakshmi S, Assistant Professor, Department of Career Guidance Cell, FSH, SRMIST*

Course Code	UMI23M01L	Course Name	MY INDIA PROJECT	Course Category	M	Mandatory	L	T	P	C
							0	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	Mathematics		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

SEMESTER - V

Course Code	UMA23111T	Course Name	Complex Analysis	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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
		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 understand the concepts of an analytic function.																		
CLR-2 :	To learn the concepts of transformation in complex variables.																		
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 and 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	4	85	80	*H*	*M*	*M*	-	-	-	-	*M*	-	*H*	-	*H*	-	-	-
CLO-2 :	Explain the transformation concepts in complex variables.	4	85	80	*H*	*H*	M	-	-	-	-	-	-	*H*	-	-	-	-	-
CLO-3 :	Explain several facts on complex integration	4	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.	4	85	80	*H*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	-	-
CLO-5 :	Evaluate the different types of real definite integrals and explain the concepts of singularities	4	85	80	*H*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to complex numbers and their geometric representation	Mappings Introduction, Conformal Mapping	Integration of complex function,simple integrals using definition	Power series	Residue at a finite point
	SLO-2	Rational powers of complex numbers	Isogonal mapping	Simple curve	Radius of convergence of the power series	Calculation of residues
S-2	SLO-1	Infinity and extended complex plane.	Magnification	Definite integrals of function	Taylor's series expansion. Theorems and propositions related to it	Calculation of residues--Examples
	SLO-2	Stereographic projection and Riemann Sphere	Magnification and rotation	Interior and exterior of a closed curve	Uniqueness theorem	Cauchy Residue theorem
S-3	SLO-1	Complex functions, Limits and Continuity	Inversion and reflection	Simply connected region and multiple connected region	Taylor's theorem-Examples	Problems based on Cauchy Residue theorem
	SLO-2	Uniform continuity, Differentiability, and analyticity of an analytic function	Transformation w=az+b	Integral along an arc joining two points	Laurent's theorem with proof	Number of zeros and poles

S-4	**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-5	**SLO-1**	Necessary condition for differentiability	Transformation, $w=z^2$	Cauchy fundamental theorem	Problem based on Laurent theorem	Rouche's theorem.
	SLO-2	Sufficient condition for differentiability	Transformation, $w=1/z$	Cauchy goursat theorem--statement	Singular point	Real definite integral . Jordan's lemma
S-6	**SLO-1**	C--R equations in polar form, Definition, examples.-.	Transformation $w=\sqrt{z}$	Cauchy integral theorem	Isolated and non isolated singularities	Evaluation of Integral of the type $\int_0^{2\pi} f(\cos\theta,\sin\theta)d\theta.$
	SLO-2	Complex function as a function of z and $\overline{z}$	Transformation $w= e^z$	Cauchy integral theorem and formula for derivatives	Removable singularity	Evaluation of Integral of the type $\int_0^{2\pi} f(\cos\theta,\sin\theta)d\theta.$
S-7	**SLO-1**	Harmonic function and multi valued function	Transformation w=sinz	Integral formula for nth derivative	Essential singularity	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\sin axdx, a>0$
	SLO-2	Analytic function-- Properties	Transformation w=cosz	Related integral theorem—Morera's theorem	Poles	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\sin axdx, a>0$
S-8	**SLO-1**	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\cos axdx, a>0$
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-9	**SLO-1**	Determination of harmonic conjugate examples	Problems based on transformation	Related integral theorem—Liouville's theorem	Behaviour of an function at an isolated singular point	Tutorial Session
	SLO-2	Determination of harmonic conjugate examples	Problems based on transformation	Generalized version of Liouville's theorem	Singularities at infinity	Evaluation of Integral of the type $\int_{-\infty}^{\infty} f(x)\cos axdx, a>0$
S-10	**SLO-1**	Construction of an Analytic function when real part is known.	Cross ratio and its invariance property	Related integral theorem—Cauchy Inequality	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 real part is known.	Bilinear transformation	Related integral theorem-Fundamental theorem of Algebra.	Determination of Nature of singularities	Evaluation of Integral of the type $\int_{-\infty}^{\infty} \frac{p(x)}{q(x)}dx$

S-11	**SLO-1**	Construction of an Analytic function when imaginary part is known	Circles and inverse points,	Schwarz's Lemma	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	Special Bilinear transformation Worked out examples	Maximum modulus principle with proof	Nature of singularities-problems	Evaluation of Integrals of the form $\int_{-\infty}^{\infty} f(x)dx$
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

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. L. Ahlfors: Complex Analysis, 3rd ed., McGraw-Hill, New York, 1979. 5. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 9th Ed.,McGraw – Hill International Edition, 2021.

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2.. Dr. V. Vidya,** vidhyav@srmist.edu.in

Course Code	UMA23112T	Course Name	MECHANICS	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	To understand the concept of mechanics, forces, and equilibrium which will be able to study simple harmonic motion and its properties
CLR-2 :	To relate the concepts of virtual work, its principles and impulse also familiar with the characteristic of elasticity
CLR-3 :	To learn concepts related to spheres and the properties
CLR-4 :	To understand concepts of motion and study in detail the motion of a projectile and trajectories
CLR-5 :	To learn the concepts of central forces and orbit

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 :	Acknowledge the existence of the mathematical representation of physical objects called simple harmonic motion	4	85	80	H	-	H	-	-	M	-	-	-	-	-	H	-	-	-
CLO-2 :	Prior knowledge of the fundamentals of simple harmonic motion	4	85	80	H	H	H	-	H	M	-	-	-	-	-	H	-	-	-
CLO-3 :	Develop a broad coverage of the topics on impulse, impulsive forces, spheres and elasticity	4	85	80	H	-	H	-	M	M	-	-	-	-	-	H	-	-	-
CLO-4 :	Examine the significance of the motion of a projectile and trajectories	4	85	80	H	-	H	H	-	M	-	-	-	-	-	-H	-	-	-
CLO-5 :	Know the fundamental concepts of two-dimensional rigid bodies such as compound pendulum, period of oscillations, centre of oscillations, and axis of a rigid body.	4	85	80	H	H	H	-	-	M	H	-	-	-	-	H	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Basic concept of Mechanics	Virtual work – Definition- Examples	Projectiles- Definition, Examples	Central Orbits- General Orbits- Definition, Examples	Two-dimensional motion of a rigid body- Definition, Examples

	SLO-2	Fundamental laws of Newtonian mechanics	Principle of virtual work	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**	Equilibrium of a particle- Triangle of forces	Solution of problems involving equilibrium by principle of virtual work.	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- Drive its Kinetic energy, angular momentum
	SLO-2	Equilibrium of a particle – polygon of forces and converse of the polygon of forces	Solution of problems involving equilibrium by the principle of virtual work.	Nature of a trajectory- Definition, Examples	Apse, maximum and minimum angular velocity- Definition, Examples	The motion of a rigid body rotating about a fixed axis - Moment, angular velocity
S-3	**SLO-1**	Lami's theorem	Work done in a stretching an elastic string Impact – More problems	Nature of a trajectory- Derive the path of a projectile is a parabola	Areal velocity, a moment of momentum – Definition, examples	Motion of a rigid body rotating about a fixed axis- Tutorials problems
	SLO-2	Necessary and sufficient conditions for equilibrium of forces	Conservative field of force -definition, examples	Height of the directrix, Distance of focus from the point of projection- Definition, examples	Coplanar motion- Definition, examples	The motion of a rigid body rotating about a fixed axis- Practice problems
S-4	**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-5	**SLO-1**	Rectilinear motion -rectilinear motion with a constant acceleration	Energy – conservation of energy – definition, Examples	Nature of a trajectory- Derive the speed of a projectile at any point equals the speed falling from the directrix	Velocity and acceleration in a coplanar motion- finding the components in two fixed perpendicular directions	Compound pendulum, centre of suspension, Definition, examples
	SLO-2	Coplanar motion-Velocity and acceleration in a coplanar motion	Power -Definition, examples	The motion of a projectile, Results pertaining to the motion of projectile- Definition, problems	velocity and acceleration of a particle - radial and transverse directions	Period, simple equivalent pendulum, centre of oscillation- Definition, examples
S-6	**SLO-1**	Simple Harmonic motion- Amplitude, Period, Phase- Definition, examples	Impulsive force- Impulse- Definition, Examples	The 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	Simple Harmonic motion- Finding velocity and acceleration	Conservation of linear momentum- Definition, Examples, Problems	Project tile projected horizontally – problems	Central orbit- practice problems	Period of small oscillations- Problems
S-7	**SLO-1**	Projection of a particle having a uniform circular motion – Problems	Impact of spheres- Laws of impact Definition- examples	Projectile projected on an inclined plane- time of flight, range on the plane	Central orbit- motion of a particle subject to the action of a central force	The period is unaltered when the centre of suspension and oscillation are interchanged

	SLO-2	Composition of two simple harmonic motions of the same period- Problems	Impact of two smooth spheres-Direct impacts of two smooth spheres-Definition, Examples	Maximum range on an inclined plane- finding the angle between the inclined plane and the vertical line	Central orbit- finding a central orbit is a plane curve	Finding the minimum period of the compound pendulum
S-8	**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-9	**SLO-1**	Simple Harmonic motion along a horizontal line- Derive the motion of a light spiral spring pulled through a distance	Two smooth spheres collide directly- Derive its Impulse imparted to each sphere	Enveloping parabola or bounding parabola - Introduction	Differential equation of a central orbit in polar coordinates	The reaction of the axis on a rigid body revolving around it
	SLO-2	Simple Harmonic Motion along a vertical line- Examples, Problems	Two smooth spheres collide directly- find the change in the total kinetic energy of the spheres	Finding the envelope of a family of trajectories from a fixed point and constant velocity	Differential equation of a central orbit in p-r coordinates- finding the equation for an attractive central force- Derivation	Resultant reaction of the axis on the rigid body problems
S-10	**SLO-1**	A motion under gravity in a resisting medium- Definitions, examples	Impact of a smooth sphere on a fixed plane- Direct impact of a smooth sphere on a plane, derive its Velocity of rebound, impulse imparted to the sphere	The motion of a projectile- more problems	A differential equation for an attractive central force – the constancy of the moment of momentum	The motion of a uniform circular disc rolling down an inclined plane – derivation
	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-	Moment of inertia- simple bodies- Definitions, Examples	Law of central force- Introduction, Inverse Square law - Method to find the central orbit – Kepler's law of planetary motion	The motion of a uniform circular disc rolling down an inclined plane – problems
S-11	**SLO-1**	Resistance proportional to a square of the speed- Derive its motion of a particle	Oblique impact of a smooth sphere on a plane- Derive its Velocity of rebound, impulse imparted to it, loss in kinetic energy	Moment of inertia - Perpendicular axis theorem- Statement only	The Central orbit of a particle under an attractive central force inversely to the square of the distance	The Motion of a system having a heavy pulley
	SLO-2	A Motion under gravity in a resisting medium- Problems	Oblique impact of a smooth sphere on a plane- more problems	Moment of inertia- Parallel axis theorem- statement only	The central orbit of a particle under an attractive force- find its nature of the orbit and critical velocity	The Motion of the system having a heavy pulley - 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

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, Mechanics, S. Chand and company Pvt. Ltd., New Delhi, 1979. 5. Synge and Griffith, Principle of Mechanics, Mcgraw-Hill Book Company,1942

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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2.Dr. G. Sheeja** sheejag@srmist.edu.in

Course Code	UMA23113T	Course Name	*Linear Algebra*	Course Category	C	*Discipline Specific Core Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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:**
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 :	Realize importance of adjoint of a linear transformation and its canonical form

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 :	Know the fundamental concepts vector spaces, subspaces, bases and dimension.	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Link matrices and linear transformations.	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Learn to compute eigen values and eigen vectors of linear transformations.	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Explain the significance of inner product spaces and their properties.	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Analyze adjoint of a linear transformation.	4	85	80	-	*H*	-	-	*H*	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	**SLO-1**	Vector space-Definition, examples	Inner product space- Definition, examples, applications	Linear Transformation-Definition, examples, Properties of Linear Transformation	Isomorphism of vector spaces, Theorems based on Isomorphism	Linear operator-Definition and examples
	SLO-2	Problems based on vector space, Elementary Properties and theorems of vector spaces.	Norm of a vector, Properties on Norm of a vector, Schwarz inequality, Triangle inequality	Algebra of Linear transformation, Product of Linear transformation	Dual space-Definition, examples	Adjoint of a Linear operator, Problems based on linear operator

S-2	**SLO-1**	Vector subspaces-Definition, examples	Orthogonal vectors, Theorems based on Orthogonal vectors	Theorems on Product of Linear transformation	Problems on Dual space	Unitary operators-Definitions and properties
	SLO-2	Problems based on vector subspace, Elementary Properties of vector subspaces	Problems involving Orthogonal vectors	Algebra of linear operator	Dual basis-Definitions, Theorems based on dual basis	Theorems on Unitary operators
S-3	**SLO-1**	Algebra of subspaces, Linear sum of two subspaces	Orthonormal vectors, Theorems based on Orthonormal vectors	Range space of linear transformation, Theorems on range space	Problems on dual basis	Normal operators-Definitions and Illustrations
	SLO-2	Direct sum of two subspaces	Problems involving Orthonormal vectors	Null space of linear transformation	Second dual space-Definition, examples	Theorems on Normal operators
S-4	**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-5	**SLO-1**	Quotient space-Definition and example	Orthogonal basis -Definition, examples	Sylverster theorem	Theorems on second dual space	Hermitian forms-Definitions, examples
	SLO-2	Elementary Properties of Quotient space	Problems on Orthogonal basis, Orthogonal complement of a subspace	Invertible Linear transformation, Theorems on Invertible Linear transformation	Natural mapping, Annihilator	Theorems based on Hermitian forms, Problems in on Hermitian forms
S-6	**SLO-1**	Internal direct sum of vector spaces	Gram-Schmidt process for constructing orthonormal basis	Problems on Invertible Linear transformation	Theorems on Annihilator, Annihilator of an Annihilator	Jordan canonical form, Problems based on Jordon canonical form
	SLO-2	External direct sum of vector spaces	Problems based on Gram-Schmidt process for constructing orthonormal basis	Non -singular Linear transformation, Theorems on non-singular linear transformation	Eigen values and Eigen vectors of a Linear transformation	Rational canonical form
S-7	**SLO-1**	Linear combination of vectors	Bessel's Inequality, Orthogonal Expansion	Matrix representation of a linear transformation	Theorems based on Eigen values	Trace of a matrix-Definition and examples, Theorems based on trace
	SLO-2	Linear dependence and Independence of vectors	The Adjoint of a Linear Transformation, Properties of the Adjoint	Problems on Matrix representation, Similarity of matrices	Problems on Eigen values	Properties of Trace, Problems on trace
S-8	**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-9	**SLO-1**	Problems based on Linear dependence of vectors, Problems based on Linear independence of vectors	Self-Adjoint Transformation-Definitions, Properties of Self-Adjoint Transformation	Similarity of linear transformation, Triangular forms	Monic polynomial, Cayley-Hamilton Theorem	Determinant of a linear transformation on of a finite dimensional vector space
	SLO-2	Basis of vector space, Problems on basis of vector space	Self-Adjoint Transformation-Definitions, Properties of Self-Adjoint Transformation	Characteristics root-Problems	Problems based on Cayley-Hamilton Theorem	Problems on Determinant of a linear transformation
S-10	**SLO-1**	Dimension of a vector space, Dimension of subspace of a vector space	Theorems on Self-Adjoint Transformation	Theorems based on Triangular forms	Minimal polynomial-Definition and examples	Transpose-Definition, examples, properties.
	SLO-2	Elementary theorems based on the dimension of a vector space.	Problems on Self-Adjoint Transformation	Canonical forms, Theorems based on Canonical forms	Problems based on minimal polynomial, Theorems based on minimal polynomial	Theorems based on Transpose, Problems based on Transpose
S-11	**SLO-1**	Linear Span-Definition and examples, Elementary Properties of Linear Span, Homomorphism, problems	Congruent Operators, Theorems on Congruent Operators, Inner Product Vector Space Isomorphism, Orthogonal Projections	Nilpotent Transformations-Definitions, examples, Basic properties, Lemmas	Primary Decomposition theorem, Diagonalization, Geometric multiplicity, Algebraic multiplicity	Rank and Nullity –Definitions, examples, Theorems based on Rank and Nullity, Invariant subspaces, Problems based on invariant subspaces

	SLO-2	Homomorphism, problems	Inner Product Vector Space Isomorphism, Orthogonal Projections	Basic properties, Lemmas	Geometric multiplicity, Algebraic multiplicity	Invariant subspaces, Problems based on invariant subspaces
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

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.

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.

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Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. 2. Dr. S. Sabarinathan,SRMIST** ***sabarins@srmist.edu.in***

Course Code	UMA23D03T	Course Name	Astronomy	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	To understand Celestial Mechanics and will be able to study about its properties	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 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.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Recognize the mathematical ideas of Astronomy	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Link the fundamental concepts of Astronomy	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Explain the significance of the classification of Astronomy	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Analyze consequences of Spherical Astronomy	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Learn about structure of Astronomy between Photometric Concepts and Magnitudes	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to Celestial Mechanics	Introduction to Spherical Astronomy and the Earth	Introduction to Photometric Concepts and Magnitudes	Introduction to Radiation Mechanisms	Introduction to The Solar System
	SLO-2	The Role of Astronomy	Spherical Trigonometry	Intensity	Radiation of Atoms	Planetary Configurations
S-2	SLO-1	Astronomical objects of research	Dip of horizon	Flux Density	Molecules	Comets
	SLO-2	Introduction to Celestial Mechanics	Twilight	Luminosity	The Hydrogen Atom	Meteorites

S-3	**SLO-1**	Equations of Motion	Diurnal motion	Geocentric parallax	Moon	Eclipses
	SLO-2	Solution of the Equation of Motion	Rising and setting of a star	Heliocentric parallax	phases of moon	Minimum and maximum number of eclipses
S-4	**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-5	**SLO-1**	Solution of the Equation of Motion	Astronomical Refraction	Extinction	Lunar eclipse	The Structure
	SLO-2	Solution of the Equation of Motion	Tangent & Cosine Formula	Optical Thickness	Solar eclipse	Surfaces of Planets
S-6	**SLO-1**	Equation of the Orbit and Kepler's First Law	Years	Internal Structure of sun	Continuous Spectra	Atmospheres
	SLO-2	Orbital Elements	Calendars	Atmosphere of Sun	Blackbody Radiation	Magnetospheres
S-7	**SLO-1**	Kepler's Second Law	Constellations	Solar Activity	Temperatures	Albedos
	SLO-2	Kepler's Third Law	Summer Constellations	Solar Wind	Other Radiation Mechanisms	Photometry
S-8	**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-9	**SLO-1**	Systems of Several Bodies	Aberration of Light	Space Weather	Radiative Transfer	Polarimetry
	SLO-2	Orbit Determination	length of a day	Introduction to Variable Stars	Introduction to Milky Way	Spectroscopy
S-10	**SLO-1**	Position in the Orbit	Observation through the atmosphere	Classification of Variable Stars	Seasonal changes in the night sky	Origin of the Solar System
	SLO-2	Escape Velocity	Optimal Telescopes	Pulsating Variable	The Classification of Galaxies	Dwarf Planets
S-11	**SLO-1**	true eccentric	Detectors and Instruments	Eruptive Variables	Dynamics of Galaxies	Stella Spectra
	SLO-2	mean anomalies	Radio Telescopes	Supernovae	Systems of Galaxies	H.R. Diagram
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

Learning Resources	1. 1. Hannu Karttunen, Fundamental Astronomy, Content Technologies Publications, 2013. 2. 2. V.Thiruvenkatacharya, A text book of Astronomy, Schand & Co. Pvt. Ltd., 1972. 3. 3. S. Kumaravelu and Susheela Kumaravelu, Astronomy, SKV Publishers, Nagarkoil, 2004.	4. ISAAC Asimos, The guide to earth and space, 1992. 5. 5. John W. Campbell, Isaac asimov, Robert A. Heinlien, The golden age of science fiction hardcover.

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. E. P. Siva** sivae@srmist.edu.in

Course Code	UMA23D04T	Course Name	Graph Theory	Course Category	D	*Discipline Specific Elective Course*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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
CLR-1 :	Introduce the fundamental concepts of graphs	
CLR-2 :	Understand the concept of Eulerian graph and Hamiltonian graph	
CLR-3 :	Culminate the matching concept and to address the planarity of graphs	
CLR-4 :	Understand the concept of graph colouring	
CLR-5 :	Acquire the knowledge of problem solving and algorithm techniques	

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 :	Describe elements of a graph and to compute its parameters	4	85	80	M	H	-	-	-	-	-	-	-	*H*	-	-	-	-	-
CLO-2 :	Model a real-world question with mathematical object	4	85	80	*H*	*H*	-	H	-	*H*	-	-	-	*H*	-	-	-	-	-
CLO-3 :	Designing and structuring complex radio electronic circuits and railway maps	4	85	80	*H*	*H*	-	H	-	*H*-	-	-	-	*H*	-	-	-	-	-
CLO-4 :	Utilize the graph coloring in pattern matching, sports scheduling and designing seating plans	4	85	80	*H*	*H*	*H*	-	-	*H*	-	-	-	*H*	-	-	-	-	-
CLO-5 :	Apply algorithm techniques to solve wide variety of real-world problems	4	85	80	*H*	*H*	-	-	-	*H*	-	-	-	*H*	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to graphs	Introduction to Euler Tour	Matching, Maximum matching-definition	Edge-colouring -definition-example	Introduction to algorithms
	SLO-2	Preliminary definitions	Euler tour-definition with example	Berge theorem with proof	Edge-chromatic-definition-example	Big O notation-Big theta notation-Big omega notation -definitions
S-2	SLO-1	Subgraph and its type	Euler trail-definition with example	Find the number of different perfect matching for K_{2n} and $K_{n,n}$	More problems on Edge-colouring and Edge-chromatic	Examples
	SLO-2	Graph Isomorphism	Euler tour-theorem with proof	Necessary and sufficient condition for existing of matching [Hall's Theorem]	Vizing's theorem with proof	Kruskal's algorithm
S-3	SLO-1	Directed graph-Indegree-out degree	Euler trail-theorem with proof	Perfect matching definition with example	Petersen graph is edge chromatic	Illustration with example
	SLO-2	Incidence matrices and adjacency matrices	Hamiltonian path and cycle definition with example	k-regular bipartite graph implies perfect matching	Vertex colouring definition with example	Prim's algorithm

S-4	**SLO-1**	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial
	SLO-2	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial
S-5	**SLO-1**	Handshaking Theorem-proof	Necessary condition for a graph to be Hamiltonian	Covering, minimum covering with examples	Chromatic number-definition with example	Illustration with example
	SLO-2	Walk-Trail-path	Converse of the above result need not be true	Theorem on maximum matching and minimum covering	Problems	Breadth first search algorithm
S-6	**SLO-1**	Complete graph-complete bipartite graph-regular graph	Dirac's Theorem	Planar graph -definition with example	k-critical -definition with example	Illustration with example
	SLO-2	Characterization of bipartite graphs	G is Hamiltonian if and only if G+uv is Hamiltonian	k_5 is non-planar graph	If G is k-critical then $\delta \geq k-1$	Depth first search algorithm
S-7	**SLO-1**	Cut edges and bonds-Definitions and Examples	Petersen graph is non-Hamiltonian	$k_{3,3}$ non-planar	Every k-chromatic graph has at least k vertices of degree at least k -1.	Illustration with example
	SLO-2	An edge e of G is a cut edge if and only if e is contained in no cycle of G	Closure of a graph	Dual graph-definition-example	Chromatic polynomial -definition with example	Examples
S-8	**SLO-1**	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial
	SLO-2	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial
S-9	**SLO-1**	Bond –Theorem with proof	construction of the closure of a graph G on six vertices	Euler's formula	Chromatic polynomial	Dijkstra's algorithm
	SLO-2	Cut vertices-Theorem-proof	Illustration with example	Problems	Theorem with proof	Illustration with example
S-10	**SLO-1**	Trees	Closure of a graph is well defined	Bridge-definition with example	Brook's theorem	Fleury's algorithm
	SLO-2	Properties of trees	Simple graph is Hamiltonian if and only if its closure is Hamiltonian	Problems	proof	Illustration with example
S-11	**SLO-1**	Spanning tree	Self-complementary-definition	Five colour theorem	Dirac's theorem	Fleury's algorithm application
	SLO-2	Minimum spanning tree-examples	Illustration with example	Proof	Proof	Illustration with example
S-12	**SLO-1**	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial
	SLO-2	Tutorial	Tutorial	Tutorial	Tutorial	Tutorial

Learning Resources	1. J.A. Bondy, U.S.R. Murty, Graph Theory with applications, Elsevier North-Holland, Newyork,1976. 2. Dougalas B.West, Introduction to Graph Theory, Pearson,Second Edition, New York,2015. 3. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory, Springer – Verlag, New york, 2012.	4. Karin R. Saoub, Graph Theory , An Introduction to Proofs, Algorithms, and Applications, CRC Press, Taylor & Francis, 2021 5. F. Harary, "Graph Theory", Marosa Publishing house, New Delhi, 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 %	

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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2.Dr. L. Shobana, SRMIST** shobanal@srmist.edu.in

Course Code	UMA23G03T	Course Name	Design of Experiments	Course Category	G	General Elective Courses	L	T	P	O	C
							3	1	0	2	4

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 basics of Experimental Designs*																		
CLR-2 :	Know how to make a plots and blocks in a design																		
CLR-3 :	Understanding different designs																		
CLR-4 :	Understanding where to apply appropriate designs																		
CLR-5 :	Analyze the designs																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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 :	*Identify the good experimental designs*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Select the size and shape of the plots and blocks	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Test the hypothesis	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Use different designs	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the designs in real life.	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	**SLO-1**	*Introduction to principles of experimental designs*	*Uniformity trial: definition*	*Factorial experiments (symmetrical): definition*	*Split plot designs – introduction*	*Lattice design - concept*
	SLO-2	*Need for designing of experiments*	*Uniformity trial: advantages and disadvantages*	*factorial experiments (symmetrical): properties*	*Split plot designs – properties*	Simple problems in Lattice design
S-2	**SLO-1**	*Characteristics of a good design*	*Size of plots*	*Factorial experiments (asymmetrical): definition*	*Split plot designs - advantages, disadvantages*	*Lattice design - analysis and interpretation of results*
	SLO-2	*Good design: applications*	*Size of blocks*	*Factorial experiments (asymmetrical): properties*	*Split plot designs - applications*	*Lattice design - analysis and interpretation of results*
S-3	**SLO-1**	*Basic principles of designs- randomization*	*Shape of plots*	*Data transformation: logarithmic,*	*Split plot design – analysis of data*	*Alpha design - concept*
	SLO-2	*Basic principles of designs- replication*	*Shape of blocks*	*angular transformation, square root transformations*	*Split plot design – analysis of data*	*Alpha design - analysis and interpretation of results*
S-4	**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-5	**SLO-1**	*Basic principles of designs-local control*	*Fairfield Smith Laws*	*Orthogonality of degrees of freedom*	*Missing plot techniques: concepts*	*Analysis of data generated from a BIB design*
	SLO-2	*Concepts of experimental material*	Applications	*Partitioning of degrees of freedom*	Problems in *Missing plot techniques:*	*Analysis of data generated from a BIB design*
S-6	**SLO-1**	*Formation of plots*	*Test of hypothesis: definition*	*Orthogonality, contrasts*	*Missing plot techniques in randomized block design*	*Combined analysis – Introduction*
	SLO-2	*Formation of blocks*	*Test of hypothesis: uses*	*Mutually orthogonal contrasts*	**Problems in** *Missing plot techniques in randomized block design*	Simple problems in combined analysis
S-7	**SLO-1**	Simple problems in *Formation of plots*	*Analysis of variance: concepts*	*Mutually orthogonal contrasts: concepts*	*Missing plot techniques in Latin square designs: properties*	*Combined analysis – Properties*
	SLO-2	Simple problems in *Formation of blocks*	*Analysis of variance: properties*	*Mutually orthogonal contrasts: applications*	*Missing plot techniques in Latin square designs: applications*	*Combined analysis – applications*
S-8	**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-9	**SLO-1**	Mathematical model in one way model	*Data transformation: logarithmic transformation*	*Concept of confoundin*	*Balanced Incomplete Block Design (BIBD) – concept and randomization procedure*	*Response surface design: definition*
	SLO-2	Assumptions in one way model	*Data transformation: angular transformation*	*confounding and applications*	*Balanced Incomplete Block Design (BIBD) - analysis and interpretation of results*	*Applications of response surface design*
S-10	**SLO-1**	Mathematical model in two way model	*completely randomized design – introduction*	*Confounding in symmetrical factorial experiments: advantages*	*Partially Balanced Incomplete Block Design (PBIBD) – concept and randomization procedure*	*Analysis of data generated from a PBIB desig*
	SLO-2	Assumptions in two way model	*Completely randomized design – properties*	*Confounding in symmetrical factorial experiments: disadvantages*	*Partially Balanced Incomplete Block Design (PBIBD) - analysis and interpretation of results*	*Analysis of data generated from a PBIB design*
S-11	**SLO-1**	Introduction to F-test	*Latin square design – introduction and properties*	*Total confounding - concepts*	*Introduction to resolvable designs*	Simple problems in *PBIB design*
	SLO-2	Simple problem in F-test	*Latin square design - advantages, disadvantages and applications*	*Total confounding - applications* *Partial confounding - concepts*	*Resolvable designs applications*	Applications in *PBIB design*
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

Learning Resources	1. Cochran, W.G. and Cox, D.R. 1987. Experimental Designs. John Wiley and Sons, New York 2. Panse, V.G. and P.V. Sukhatme. 1967. Statistical Methods for Agricultural Workers. 2nd Edition, Indian Council of Agricultural Research, New Delhi 3. Rangaswamy, R (2009) A text book of Agricultural Statistics. New Age International (P) Ltd.	4. National agriculture statistics service, Agriculture Statisticss, Bernan press, 2017. 5. G. Nageswara rao, Statistics for agricultural sciences, BS publications, 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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr.L.S.Senthilkumar** senthill@srmist.edu.in

Course Code	UMA23G04T	Course Name	*Data Structures and Algorithms*	Course Category	G	*General Elective Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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
CLR-1 :	Design efficient algorithms in solving complex real time problems			
CLR-2 :	Analyze various algorithm design techniques to solve real time problems in polynomial time			
CLR-3 :	Utilize various approaches like matrix representation to solve algorithms			
CLR-4 :	Utilize Sorting techniques to solve some real time problems			
CLR-5 :	Analyze the need of approximation and randomization algorithms using hashing functions			

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 :	Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations	*4*	85	80	*H*	-	*H*	*H*	-	-	-	-	-	-	-	-M	-	-	-
CLO-2 :	Solve problems using various techniques of Queues	*4*	85	80	*H*	H	*M*	-	*M*	-	-	-	-	-	-	*M*	-	-	-
CLO-3 :	Apply programming techniques to solve polynomial time problems.	*4*	85	80	*H*	-	*H*	-	*M*	-	-	-	-	-	-	*M*	-	-	-
CLO-4 :	Create problems using binary search and sorts and bound approaches.	*4*	85	80	*H*	-	*M*	*H*	*M*	-	-	-	-	-	-	*M*	-	-	-
CLO-5 :	Interpret various approximation algorithms using Hashing functions	*4*	85	80	*H*	*M*	*M*	-	-	*H*	-	-	-	-	-	*M*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	**SLO-1**	Basics Algorithm Specifications	Reverse Polish Expression and Their Compilation	Nonlinear Data Structure:	Sorting and searching	Hashing and File Structures
	SLO-2	Performance Analysis and Measurement	Reverse Polish Expression and Their Compilation	Tree-Definitions and Concepts	Sorting and searching	Hashing and File Structures
S-2	**SLO-1**	Time and space analysis of algorithms	Recursion, Tower of Hanoi	Representation of binary tree	Insertion Sort	Hashing: The symbol table
	SLO-2	Average, best- and worst-case analysis.	Recursion, Tower of Hanoi	Representation of binary tree	Insertion Sort	Hashing: The symbol table
S-3	**SLO-1**	Introduction to Data Structure	Queue: Representation of Queue, Operations on Queue	Binary tree traversal (Inorder, postorder, preorder)	Quick Sort	Hashing Functions

	SLO-2	Data Management concepts	Queue: Representation Of Queue, Operations On Queue	Binary tree traversal (Inorder, postorder, preorder)	Quick Sort	Hashing Functions
S-4	**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-5	**SLO-1**	Types of Data Structures- Linear & Non-Linear Data Structures	Array representation of Priority Queue, Double Ended Queue	Applications of Trees- Some balanced tree mechanism	Heap Sort	File Structure: Concepts of fields
	SLO-2	Types of Data Structures- Linear & Non-Linear Data Structures	Array representation of Priority Queue, Double Ended Queue	Applications of Trees- Some balanced tree mechanism	Heap Sort	File Structure: Concepts of fields
S-6	**SLO-1**	Linear Data Structure Array: Representation of arrays	Applications of Queue	AVL trees, 2-3 trees, Height Balanced, Weight Balance	Sorting on Several Keys	Records and files
	SLO-2	Types of Data Structures- Linear & Non-Linear Data Structures	Array representation of Priority Queue, Double Ended Queue	Applications of Trees - Some balanced tree mechanism	Heap Sort	File Structure: Concepts of fields
S-7	**SLO-1**	Applications of arrays, sparse matrix and its representation.	Linked List: Singly Linked List	Graph-Matrix Representation of Graphs	List and Table Sort	Indexed and Relative / Random File
	SLO-2	Applications of arrays, sparse matrix and its representation.	Linked List: Singly Linked List	Graph-Matrix Representation of Graphs	List and Table Sort	Indexed and Relative / Random File
S-8	**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-9	**SLO-1**	Applications of arrays, sparse matrix and its representation.	Linked List: Singly Linked List	Graph-Matrix Representation of Graphs	List and Table Sort	Indexed and Relative/Random File
	SLO-2	Applications of arrays, sparse matrix and its representation.	Linked List: Singly Linked List	Graph-Matrix Representation of Graphs	List and Table Sort	Indexed and Relative/Random File
S-10	**SLO-1**	Linked implementation of Stack	Elementary Graph operations: Breadth First Search, Depth First Search	Linear Search	Organization, Indexing structure for index files	Linked implementation of Stack
	SLO-2	Stack: Stack-Definitions & Concepts, Operations on Stacks	Linked implementation of Stack	Elementary Graph operations: Breadth First Search, Depth First Search	Stack: Stack-Definitions & Concepts, Operations on Stacks	Linked implementation of Stack
S-11	**SLO-1**	Applications of Stacks, Polish Expression	Applications of linked list.	Spanning Trees, Shortest path, Minimal spanning tree	Binary Search.	Hashing for direct files, multi-Key file organization and access methods.
	SLO-2	Applications of Stacks, Polish Expression	Applications of linked list.	Spanning Trees, Shortest path, Minimal spanning tree	Binary Search.	Hashing for direct files, multi-Key file organization and access methods.
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

Learning Resources	1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill. 2017 2. Data Structures using C & C++ by Langsam, Augenstein, Tenenbaum, Pearson, 2015.	3. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed. 4. Fundamentals of Data Structures in C++- by Sartaj Sahni.2006. 5. Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher-Thomson Learning. 2004

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
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		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
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	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
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Course Code	UMA23S03L	Course Name	Mathematical Software SCILAB	Course Category	S	Skill Enhancement Course	L	T	P	O	C
							0	0	2	2	1

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 :	Exploit the numerical manipulation towards scientific advancement using 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-2 :	Employ various numerical methods in Scilab																		
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																		
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	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Perceive the importance of Scilab and its usage to solve mathematical problems	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understand the concept of various numerical techniques	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Basic computations using the functions and variables of Scilab	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Understand the importance and application of computations	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1 S-2	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-3 S-4	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
	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
S-5 S-6	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 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 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%	-	40%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%	-	20%	-	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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. S. Athithan,** athithas@srmist.edu.in

Course Code	UMA23P02L	Course Name	Internship – II	Course Category	P	*Internship/Apprenticeship / Project/ Community Outreach*	L	T	P	O	C
							0	*0*	*0*	*0*	*1*

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:*
CLR-1 :	*Gain practical experience within the business environment.*
CLR-2 :	*Acquire knowledge of the industry in which the internship is done.*
CLR-3 :	*Apply knowledge and skills learned in the classroom in a work setting*
CLR-4 :	*Develop a greater understanding about career options while more clearly defining personal career goals*
CLR-5 :	*Experience the activities and functions of business professionals.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)	PLO 1 Fundamental Knowledge	PLO 2 Application of Concepts	PLO 3 Link with Related Disciplines	PLO 4 Procedural Knowledge	PLO 5 Skills in Specialization	PLO 6 Ability to Utilize Knowledge	PLO 7 Skills in Modeling	PLO 8 Analyze, Interpret Data	PLO 9 Investigative Skills	PLO 10 Problem Solving Skills	PLO 11 Communication Skills	PLO 12 Analytical Skills	PLO 13 ICT Skills	PLO 14 Professional Behavior	PLO 15 Life Long Learning
CLO-1 :	*Identify areas for future knowledge and skill development*	*3*	*80*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-2 :	*understanding of what is expected in the job market and what their standard of performance should be*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*Build professional, as well as academic, contacts and begin the process of networking and support for your future careers.*	*3*	*75*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-4 :	*Acquire knowledge of the industry in which the internship is done.*	*3*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-5 :	*practical experience within the business environment*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-

PROCESS	
Stage I	Identifying area of interest
Stage II	Review I
Stage III	Review II
Stage IV	Review III
Stage V	Final Submission of the Project Report (Thirty pages minimum)

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. .Dr. R. Perumal perumalr@srmist.edu.in

SEMESTER - VI

Course Code	UMA23114T	Course Name	FLUID DYNAMICS	Course Category	C	*Discipline Specific Core Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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 :	To understand the basic concepts in fluid mechanics	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	To be thorough with the conservation laws	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 :	To familiarize with vortex dynamics, velocity potential and stream functions																		
CLR-4 :	To understand the importance of dimensional analysis																		
CLR-5 :	To be acquainted with linear stability analysis of benchmark problems in fluid mechanics																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Apply the Knowledge of basic Definitions of fluid dynamics	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Gain familiarity in Fluid dynamics and conservation of laws and apply them to the problems involving Science and Engineering	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply the knowledge of Stream function and Milne Thompson theorem applications in engineering problems	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	To gain the knowledge of Two-dimensional flow and vorticity diffusion and apply them in the problems involving	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	To gain the knowledge of Navier stokes equation and apply in the problems involving Science and Engineering	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	**SLO-1**	Basic properties of fluids and concept of continuum and Physical dimensions	Motion of fluid elements: translation, rotation and deformation	Two dimensional flows	Dimensional Analysis in fluid dynamics	Navier-Stokes equations for viscous fluid
	SLO-2	Viscosity, real and inviscid fluids, Newtonian and non-Newtonian fluids	strain-rate tensors and incompressibility constraints	Problems in two-dimensional flow	Buckingham's pi theorem	Navier-Stokes equations for viscous fluid
S-2	**SLO-1**	Problems in Real and ideal fluids	stream function and Problems of stream function	Use of cylindrical polar co-ordinates	Problems in Buckingham's pi theorem	Limitations of Navier-Stokes equations
	SLO-2	Velocity, acceleration	Pressure at a point in a fluid and related problems	Problems in Cylindrical polar coordinates	Dynamic similarity Problems using dynamic similarity	Some exact solutions of Navier
S-3	**SLO-1**	Problems in velocity, Acceleration	Boundary conditions and formulation of boundary conditions	Velocity derived from stream function	Significance of some dimensionless numbers: Reynold's no., Prandtl no., Eckert no., Mach no., Peclet no.	Some exact solutions of Navier Stokes equations

	SLO-2	Streamlines, path lines, Streak lines	Boundary conditions of two inviscid immiscible fluids	Stagnation point and its application in engineering problems	Dynamic similarity Applications	Flows at small Reynolds numbers
S-4	**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-5	**SLO-1**	Problems in streamlines, path lines, streak lines	Integral forms of Conservation Reynolds Transport Theorem	Complex potential for two-dimensional flows	Vorticity diffusion	Prandtl's boundary layer
	SLO-2	Steady and unsteady flows and its application	Application of Reynolds Transport theorem in conservation of mass and linear momentum	Problems in complex potential	Steady flow between parallel plates	Importance of boundary layer theory in fluid flow problem
S-6	**SLO-1**	Uniform and non-uniform flows with applications	Euler's equations of motion and Problems in Euler's equations of motion	Irrotational, incompressible flow	Problems in steady flow between parallel plates	Definitions of different Boundary layer thickness
	SLO-2	Rotational and irrotational flows with applications	Applications of Euler's equations of motion in engineering	Problems in Irrotational and in compressible flow	Plane Couette Flow	Drag and lift and local skin friction coefficient
S-7	**SLO-1**	Velocity potential and Vorticity vector	Steady and unsteady Bernoulli's equation	Complex potential for standard two-dimensional flows	Hagen- Poiseuille flow through circular pipe	Boundary layer equation of two-dimensional flow
	SLO-2	Problems in vorticity vector	Problems in Bernoulli's equation	Problems in complex potential	Problems in circular pipe	Related problem
S-8	**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-9	**SLO-1**	Lagrangian and Eulerian method of describing fluid motion	Some potential theorems	Sources and sinks in two dimensions	Applications of circular pipe in engineering	Boundary layer flow over a flat plate
	SLO-2	Material, local and convective derivative	Problems using Potential theorem	Two-dimensional image systems	Steady flow between two co-axial cylinders	Boundary layer flow over a flat plate
S-10	**SLO-1**	Equation of continuity	Axial symmetry and Asymmetry	Milne-Thomson circle theorem and related problems	Problems in two axial cylinders	Similar solutions of boundary layer equations
	SLO-2	Problems using equation of continuity	Axial symmetry and Asymmetry	Blasius Mathematical formulation and solution procedures	Laminar flow in between two concentric rotating cylinders	Similar solutions of boundary layer equations
S-11	**SLO-1**	Conditions at a rigid boundary	Flows involving axial symmetry.	Problems using Blasius mathematical formulation	Laminar flow in between two concentric rotating cylinders	Related problems
	SLO-2	Problems using Conditions at a rigid boundary	Problems in axial symmetry	Problems using Blasius mathematical formulation	Applications of flow in rotating cylinder in engineering	Related 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

Learning Resources	1. Chorlton, Textbook of Fluid Dynamics, CBS Publishers, 1998. 2. P. K. Kundu and I. M. Cohen, Fluid Mechanics, Academic Press London, 2002. 3. L.M. Milne Thomson, Theoretical Hydrodynamics, Dover Publication, 1962	4. S.K. Som, G. Bisawas, S. Chakraborty, Introduction to fluid mechanics and fluid mechanics, McGraw Hill Pvt. Ltd., 2011. 5. M.D. Raisinghania, Fluid Dynamics, S. Chand and Company Pvt. Ltd., 1982.

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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. Tanmoy Chakraborty,** tanmoyc@srmist.edu.in

Course Code	UMA23115T	Course Name	Neural Networks and Numerical Optimization	Course Category	C	*Discipline Specific Core Courses*	*L*	*T*	*P*	*O*	*C*
							3	*1*	*0*	*2*	*4*

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
CLR-1 :	To understand basics of neural networks	
CLR-2 :	To learn fundamental unit perceptron and its properties	
CLR-3 :	To learn and implement Linear regression and estimations	
CLR-4 :	Understand optimization problems	
CLR-5 :	To understand optimization techniques	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	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 PSO -1	14 PSO -2	15 PSO-3
CLO-1 :	Understand and pose leaning problems using neural networks	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Solve, implement and execute small leaning problems	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Implement code for optimization techniques	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Implement back propagation algorithms	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Write code on leaning problem using open source data	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Neural network	Linear regression model	Unconstrained optimization	Step length selection algorithms	Large-Scale Unconstrained Optimization
	SLO-2	Neural network as graph	Preliminary considerations	Local minimizer, First order necessary conditions	Interpolation	Inexact Newton Methods
S-2	SLO-1	Feedback in NN	Maximum A posteriori (MAP)estimation	second order necessary conditions	Trust Region methods	Line Search Newton–CG Method
	SLO-2	Network architectures	Four density functions	Second order sufficient conditions	Outline of Trust region	Trust-Region Newton–CG Method
S-3	SLO-1	Learning processes	Parameter estimation in a Gaussian	Two strategies	Mor'e and Sorensen theorem	Approximating the Gradient
	SLO-2	Learning tasks	Assumption	Line search and trust region	Cauchy Point	Approximating the Hessian
S-4	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-5	SLO-1	Rosenblatt's perceptron	Least squares estimation (LSE)	Line search methods	Global Convergence	The Wiener filter
	SLO-2	Perceptron visualization	Relationship between LSE and MAP	Step length	Convergence to Stationary Points	Least Squares algorithms
S-6	SLO-1	Perceptron Convergence Theorem	Minimum Description length principle	Wolfe conditions,	Conjugate gradient methods	The least square algorithm
	SLO-2	Perceptron Convergence Theorem	Model order selection	Goldstein conditions	Conjugate Direction Methods	Virtues and limitations of LSA
S-7	SLO-1	Bye's classifier	Attributes of MDL Principle	Convergence of line search methods	Basic Properties of the CG	Learning rate
	SLO-2	Bye's classifier	Finite Sample size considerations	Convergence of line search methods	Rate of Convergence	Annealing schedules

S-8	**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-9	**SLO-1**	Relation between perceptron and Bye's classifier	network Bias and variance	Steepest Descent method	Preconditioning	Multilayer perceptrons
	SLO-2	Relation between perceptron and Bye's classifier	Bias Variance Dilemma	Convergence rate	Practical Preconditioners	Batch learning and online learning
S-10	**SLO-1**	Batch perceptron algorithm	The Instrumental variable method	Newton method	Nonlinear Conjugate Gradient Methods	Back Propagation Algorithm
	SLO-2	Perceptron cost function	Noisy regressor	Theorem on Newton's method	The Fletcher–Reeves Method	Two phase computation
S-11	**SLO-1**	Batch version of the perceptron convergence algorithm	The least mean square algorithm	Quasi Newton method	The BFGS Method	Activation function and rate of learning
	SLO-2	Batch version of the perceptron convergence algorithm	Filtering structure of LMS	Newton method with Hessian	Properties of the BFGS Method	Stopping criteria
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

Learning Resources	1. Simon Haykin, Neural Networks and Learning Machines, Third Edition, Pearson Prentice hall, 2009. 2. Jorge Nocedal, Stephen Wright, Numerical Optimization, second edition, Springer, 2006. 3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011	4. S.S. Sivanandam and S. N. Deepa, Soft Computing: Techniques and Applications, third edition, WILEY INDIA, 2008 5. Jang, J.S. R., Sun, C.T., Mizutani, E., Soft Computing: An Introduction. Prentice-Hall, 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.

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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. Ritesh Kumar Dubey,** riteshkd@srmist.edu.in

Course Code	UMA23116T	Course Name	RESEARCH METHODOLOGY	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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
		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 :	Get overall picture of research methodology																		
CLR-2 :	Learn the importance of modern statistical tools for research																		
CLR-3 :	Learn optimization tools, modeling tools, and case studies in the domain of study																		
CLR-4 :	Search and find research resources and to review it																		
CLR-5 :	Get expertise in academic writing and presentation skills																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	*Demonstrate ability to identify topic and draft research proposal using the scientific methods of enquiry.*	*4*	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Apply statistical principles in data collection, analysis, inference and prediction.*	*4*	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Apply basic principles and modern tools to model and simulate engineering systems.*	*4*	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Carry out literature survey / review in research domains using online, library resources and modern tools.*	*4*	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Write project proposals, research reports, and publish the work with ethical and moral responsibilities.*	*4*	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to research methodology need	Need for data, type of data	Optimization studies, techniques, and modern	Source of information - ICT enable tools	Preparation of project proposal for funding
	SLO-2	Research- definitions, Objective of Research	Measurement: Concept of measurement - What is measured? Problems in measurement in research	Optimization studies, techniques, and modern	Databases, repositories, public and private sources, indexes	Identification of funding agencies - Format - Elements of style
S-2	SLO-1	Purposes of Research	Validity and Reliability Levels of measurement - Nominal, Ordinal, Interval, Ratio.	Maxima & Minima, Conditions of Optimality	Literature search – keywords, background and forward research	Research report writing; identification of line argument-articles type
	SLO-2	Types of research and its goals with example	Validity and Reliability Levels of measurement - Nominal, Ordinal, Interval, Ratio.	Linear Programming Problem (Introduction, Formation of LPP, Graphical method of solution).	Area of Research background knowledge - new approach	Communication model -audience analysis-teaching for audience

S-3	**SLO-1**	Prospective of stakeholders	Data Collection: Primary and Secondary Data Sources.	Tools Used in the Field of Studies: Case Study exercise	Quality measurement tools Citation Index and Impact Factor	Identification of suitable journal format - Instructions to authors - Structure - Major headings
	SLO-2	Stages of Research	Data Collection Methods; Data Processing; Classification of Data	Homomorphism and Isomorphism on Rings and Prime ideal	h-Index, i10 Index and JCR	Writing discussion & conclusion
S-4	**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-5	**SLO-1**	Basic Research, Applied Research	Basic probability Distribution – application in Science, Engineering	Modeling and Simulation in the Field of Studies	Reading research articles -meta-analysis	Conference presentation types: Oral, poster-difference audience interaction
	SLO-2	Distinguish between Basic Research and Applied - Research	Normal distribution exercise problem solving using software tool	Modeling and Simulation in the Field of Studies	Literature review, Grouping analyzing & comparison of articles	Synopsis -Thesis – extended abstract – graphical, video abstract – short communication
S-6	**SLO-1**	Qualitative Research with example	Binomial, Poisson distribution - exercise problem solving using software tools	Case study use case	Reporting literature review	Contribution of work -Novelty – innovation - examples
	SLO-2	Quantitative Research with example	Weibull distribution exercise problem solving using statistical tool	Case study use case	Literature review	Referencing style tools for referencing; Appendix- Manual for preparation of synopsis
S-7	**SLO-1**	Concept of measurement, causality, generalization, and replication. Merging the two approaches.	Sampling types, Size of sample -sample design	Exercise	Literature gap, refining research question and objectives-case studies	Thesis writing structure; Preliminary pages, Main body- References content - material
	SLO-2	Left and right cosets	Examples	Properties of Integral Domain	Polynomial ring is an Euclidean ring	Evaluation of thesis -examiner report – example – oral defense
S-8	**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-9	**SLO-1**	Scientific Research (Method of Scientific Enquiry)	Sampling test-Student t-test -application in science, engineering- exercise problem solving using statistical tools	Recent inventions and innovations in the field of studies -case study	Identification of research methods-Experimental Results- examples	Tutorial on writing an abstract from a manuscript
	SLO-2	Objects of Scientific enquiry-examples	F-test – its application in research studies-exercise problem solving using statistical tools	Recent inventions and innovations in the field of studies -case study	Identification of research methods-Experimental Results- examples	Tutorial on writing an abstract from a manuscript
S-10	**SLO-1**	Modes of Thinking	χ^2-test – its application in research studies-exercise problem solving using statistical tools	Recent inventions and innovations in the field of studies -case study	Intellectual Property Rights-Motivation - WIPO and WTO -IPR laws-TRIPS	Tutorial on writing an materials and methods and methodology/ experiments.
	SLO-2	Critical Thinking Vs Creative Thinking	Correlation and regression analysis	Adoption of Artificial Intelligence and machine learning tools in the field of study-case study	Copyright -Patent-invention-trademark-trade secret-Geographical indication - industrial designs – technology transfer	Tutorial on writing an experimental result using charts and graph
S-11	**SLO-1**	Templates for design problem definition	Time series analysis and Forecasting	Adoption of Artificial Intelligence and machine learning tools in the field of study-case study	Patenting procedure: Patent search -case studies	Tutorial on writing discussion section from experimental results and literature review
	SLO-2	Research proposal- rational techniques to find research ideas	Problems in Cauchys theorem of non abelian groups	Problems in Principle Ideal	Problems in Polynomials in rational fields	Examples of algebraic extension
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

Learning Resources	1. Mukherjee, S. P. (2019). A guide to research methodology: An overview of research problems, tasks and methods. CRC Press, New Delhi 2. Paul D. Leedy, Ormrod, J. E., & Johnson, L. R. (2014). Practical research: Planning and design (p. 360). Pearson Education. 3. Chandra, V., Hareendran, A. (2017). Research Methodology by Pearson 1st Edition. Pearson Education India.	4. Gastel, B., Day, R. A. (2022). How to write and publish a scientific paper. ABC-CLIO. 5. Ross, S. M. (2020). Introduction to probability and statistics for engineers and scientists. Academic press.

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
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Course Code	UMA23D05T	Course Name	Financial Mathematics	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	To provide an introductory on Financial Mathematics.
CLR-2 :	To understand Asset Pricing and Stochastic Process under finance
CLR-3 :	To know the techniques of Black Scholes model, arbitrage, option values, European options, and American option in problem in Financial Engineering
CLR-4 :	To Apply the concept of Stochastic differential equations in problems of Financial Engineering
CLR-5 :	To gain knowledge of Brownian motion and Binomial Methods in problems involving the Financial Engineering

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
		1	2	3	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 :	Gain familiarity in the knowledge Stock Market, Investment and securities, Stock return, Risk, Option and futures.	4	85	80	*H*	*H*	-	*H*	*H*	-	-	-	-	-	*L*	*H*	-	-	-
CLO-2 :	Gain familiarity in the knowledge of Asset Pricing and its properties, Markov property and Martingale property its applications in the problems involving Financial Engineering	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	*L*	-	-	-	-
CLO-3 :	To gain the knowledge of Black Scholes equation, Arbitrage, European options, and American option in Financial Engineering	4	85	80	*H*	*H*	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Gain knowledge in the solution of Stochastic differential equations, Ito Calculus, One-dimensional diffusion process, and Multidimensional diffusion process Its applications in financial engineering problems	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Gain the knowledge of Brownian motion, Limit of scaled random walks, and Binomial methods in the problems involving Financial Engineering	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	voidIntroduction to Mathematical Finance	One-period binomial model	The Black-Scholes Formula	Stochastic differential equations Introduction	Definition of Brownian motion
	SLO-2	Recognize the relationships between different areas of	One-period binomial model, Example	Scaling time and model parameters	Stochastic differential equations	Brownian motion

		Mathematics and financial market and the connections				
S-2	SLO-1	financial markets by efficient allocation of investment	The Fundamental Theorems of Asset Pricing	Using the Central Limit Theorem to obtain a limit	Example	Example
	SLO-2	Introduction, The Time Value of money, Financial Instruments like Equities, Commodities, Currencies, Indices,	The Fundamental Theorems of Asset Pricing	The role of volatility	Example	Limit of scaled random walks
S-3	SLO-1	Fixed – Income securities, Inflation proof bonds,	The Binomial Asset Pricing Model	Arbitrage	Ito Calculus	Quadratic variation of Brownian motion
	SLO-2	Financial markets	Pricing by replication in a multiperiod model	Option values	Ito Calculus	Quadratic variation of Brownian motion
S-4	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-5	SLO-1	Understand different Financial instruments and analyze various financial markets.	Introduction to Weiner process	Payoffs and Strategies	Ito Calculus	The problem of integration concerning Brownian motion
	SLO-2	Options	Weiner process	Put-Call Parity	Properties, Example	The problem of integration concerning Brownian motion
S-6	SLO-1	Options	Properties	Example	Properties, Example	Binomial methods
	SLO-2	Example	Example Weiner process	Black-Scholes equation	One dimensional diffusion process	Option valuation
S-7	SLO-1	Forward contracts	Introduction to Markov property	Similarity solution and Exact formulae for European options	One dimensional diffusion process	Dividend-paying Stock
	SLO-2	Forward contracts	Markov property, Example	American option, Call and Put options	Example	Example
S-8	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-9	SLO-1	Pricing by no-arbitrage considerations	Introduction to Martingale Property	Call and Put options	Multidimensional diffusion process	Monte Carlo Simulation: valuation by simulation
	SLO-2	Pricing by no-arbitrage considerations	Martingale Property, Example	Application	Multidimensional diffusion process	Example
S-10	SLO-1	Pricing by no-arbitrage considerations	Martingales and European derivative securities	Binomial Methods:	Example	Grouping by Similarities
	SLO-2	Example	The risk-neutral probability measure	Option valuation	Application	Example
S-11	SLO-1	Market Index	The risk-neutral probability measure	Dividend-paying stock	Poisson Process	Stylized Empirical Facts of Asset Returns
	SLO-2	Market Index	Example	General formulation and implementation	Poisson Process	Example
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

Learning Resources	1. D.G. Luenberger, *Investment Science,* Oxford University Press 2. B. Oksendal, *Stochastic Differential Equations,* Springer-Verlag 3 S. M. Ross, *An Introduction to Mathematical Finance*, Cambridge University Press, 1999.	**4.** . M Capinski and T. Zastawniak *Mathematics for Finance: An Introduction to Financial Engineering*, Springer-Verlag, London, 2003. 5. Z. Bodie- A Kare, A. J Marcus, P.Mohanty *Investments, 6th Edition*, TMH 6. Y.D. Lyuu *Financial Engineering and Computation*. Cambridge University Press -2002.

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
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Course Code	UMA23D06T	Course Name	Mathematical Modelling	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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
CLR-1 :	*Understand the concept of mathematical modelling and its importance*	
CLR-2 :	*Study the concept of Discrete time linear models*	
CLR-3 :	*Analyze the discrete time prey-predator model*	
CLR-4 :	*Study the concept of continuous time linear models*	
CLR-5 :	*Analyze the continuous time prey-predator model*	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 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 :	*Understand the process, factors and role of mathematical modelling.*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Acquire knowledge about discrete time linear models*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Examine the discrete time prey-predator model*	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Acquire knowledge about continuous time linear models*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Examine the continuous time prey-predator model*	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Mathematical modelling-Introduction	Population dynamics	Simple prey-predator models	Introduction to continuous time modeling	Introduction to continuous time prey-predator model
	SLO-2	Mathematical modelling and its importance	Fibonacci rabbit model	Discrete logistic type model	Introduction to continuous time modeling	Continuous time prey-predator model
S-2	SLO-1	Process of mathematical modelling	Linear cell division model	stability	Introduction to differential equations	Formation of prey-predator model
	SLO-2	Factors of mathematical modelling	Linear difference equation with constant coefficients	Periodic solutions	Introduction to differential equations	Stability analysis of prey-predator model
S-3	SLO-1	Applications of mathematical models	Linear prey-predator model	Bifurcations	Geometrical meaning of a differential equation	Stability by Jacobian
	SLO-2	Applications of mathematical models	Linear prey-predator model	Types of bifurcations	Geometrical meaning of a differential equation	Stability by Jacobian
S-4	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-5	**SLO-1**	Scope of mathematical modelling	Stability analysis of linear systems-Matrix approach	Logistic difference equation	Types of solutions of ODE	Null-cline
	SLO-2	Scope of mathematical modelling	Stability analysis of linear systems-Matrix approach	Logistic difference equation	Types of solutions of ODE	Null-cline
S-6	**SLO-1**	Scope of mathematical modelling	Bernoulli-Lewis – Leslie (BLL) model	Analysis on logistic difference equation	Methods to solve first order first degree differential equation	Phase diagram
	SLO-2	Mathematical methods of modelling	Projection Matrix	Periodically stable solutions	Methods to solve first order first degree differential equation	Phase diagram
S-7	**SLO-1**	Mathematical methods of modelling	Leslie Matrix	A resource limiting prey-predator model	Method of separation of variables	Phase diagram of prey-predator model
	SLO-2	Mathematical methods of modelling	Jury's stability test	A resource limiting prey-predator model	Method of separation of variables	Phase diagram of prey-predator model
S-8	**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-9	**SLO-1**	Classification of mathematical models	Physical significance of eigen values	Prey-predator models	Homogeneous differential equations	Phase diagram of prey-predator model
	SLO-2	Classification of mathematical models	Physical significance of eigen values	Prey-predator models	Homogeneous differential equations	Phase diagram of prey-predator model
S-10	**SLO-1**	Classification of mathematical models	Power method to compute eigen values numerically	Prey-predator models	Linear equations	Phase diagram of prey-predator model: Realistic nature of model using logistic growth of prey species.
	SLO-2	Classification of mathematical models	Power method to compute eigen values numerically	Prey-predator models	Linear equations	Phase diagram of prey-predator model: Realistic nature of model using logistic growth of prey species.
S-11	**SLO-1**	Classification of mathematical models	LR method to compute eigen values numerically	Effect of limited resources on prey – predator model	Homogeneous linear differential equations	Phase diagram of prey-predator model: Spiral nature when prey having logistic growth.
	SLO-2	Classification of mathematical models	LR method to compute eigen values numerically	Effect of limited resources on prey – predator model	Homogeneous linear differential equations	Phase diagram of prey-predator model: Spiral nature when prey having logistic growth.
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

Learning Resources	1. Mathematical Biology II: Spatial Models and Biomedical Applications, Third Edition, J.D Murray, Springer. 2. J N Kanpur, Mathematical Models in Biology & Medicine PB, Affiliated East West Press Pvt Ltd – New. 3. Fred Brauer, Carlos Castillo – Chavez, Mathematical Models in Population Biology and Epidemiology, Springer New York Dordrecht Heidelberg London, 2012.	4. Frank R. Giordano, Maurice D. Weir and William P. Fox, A First Course in Mathematical Modeling, Thomson Learning, London and New York, 2003. 5. James C. Robinson, An Introduction to Ordinary Differential Equations, Cambridge University Press, New York, 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	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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. R. Senthamarai, SRMIST.** senthamr@srmist.edu.in

Course Code	UMA23G05T	Course Name	Queuing Theory and Reliability	Course Category	G	General Elective Courses	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the concept of queueing models and apply in engineering problems.	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 understand the significance of advanced queueing models using Kendall's notation.																		
CLR-3 :	To understand the significance of Markov chain rule.																		
CLR-4 :	To understand the basic concepts and techniques of reliability models.																		
CLR-5 :	To understand the concepts of reliability and maintainability.																		
CLO-1 :	Solving and analyzing the problems in queuing models.	4	85	80	H	-	-	-	-	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Solving and analyzing the problems in advanced queuing models.	4	85	80	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Solving and analyzing the problems in using Markov chain rule.	4	85	80	H	-	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-4 :	To acquire knowledge of reliability and related models.	4	85	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the concept of reliability and maintainability in engineering.	4	85	80	H	H	-	-	-	-	M	-	-	-	-	-	-	-	-

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

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to queuing theory	Multiple server model with infinite system capacity of the model (M/M/s) : (∞/FIFO)	Introduction to stochastic process with examples	Introduction of reliability and examples	Introduction to redundancy technique in system design
	SLO-2	Introduction to queuing models	Characteristics of infinite capacity, multiple server Poisson queue model	Markov process, Markov chain.	Failures and failures modes	Component verses unit redundancy
S-2	SLO-1	Symbolic representation of queuing models	Problems on model (M/M/s) : (∞/FIFO)	Past and future step and state	Causes of failures	Problems on component verses unit redundancy
	SLO-2	Characteristics of queuing models	Problems on model (M/M/s) : (∞/FIFO)	One step transition probability and n step transition probability	Mean time to failure	Weakest link technique
S-3	SLO-1	Introduction to Poisson distribution, arrival rate and arrival time	Problems on model (M/M/s) : (∞/FIFO)	Chapman Kolmogorov theorem	Introduction to Hazard models	Problems on weakest link technique
	SLO-2	Introduction to exponential distribution, service rate and service time	Problems on model (M/M/s) : (∞/FIFO)	Applications on Chapman Kolmogorov theorem	Linear and nonlinear - Hazard models	Mixed redundancy
S-4	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-5	**SLO-1**	Single server model with infinite system capacity of the model (M/M/1) : (∞/FIFO)	Multiple server model with finite system capacity of the model (M/M/s) : (k/FIFO)	Transition probability matrix and applications	Time dependent Hazard models	Standby redundancy
	SLO-2	Characteristics of infinite capacity, single server Poisson queue model $P_0, P_n, L_s, L_q, W_s, W_q$	Characteristics of finite capacity, multiple server Poisson queue model	Initial probability distribution problems using Markovian chain	Stress dependent Hazard models	Redundancy optimization
S-6	**SLO-1**	Problems on model (M/M/1) : (∞/FIFO)	Problems on model (M/M/s) : (k/FIFO)	Initial probability distribution problems using Markovian chain	Introduction to system reliability models	Double failures and redundancy
	SLO-2	Problems on model (M/M/1) : (∞/FIFO)	Problems on model (M/M/s) : (k/FIFO)	Classification of state of a Markov chain	System with components in series	Double failures and redundancy
S-7	**SLO-1**	Problems on model (M/M/1) : (∞/FIFO)	Problems on model (M/M/s) : (k/FIFO)	Irreducible, non-irreducible, periodic, aperiodic, persistent, non-null persistent	System with parallel components	Maintainability function
	SLO-2	Single server model with finite system capacity of the model (M/M/1) : (k/FIFO)	Problems on model (M/M/s) : (k/FIFO)	Problems on classification of state of a Markov chain	k out of n system	Maintainability function
S-8	**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-9	**SLO-1**	Characteristics of finite capacity, single server Poisson queue model $P_0, P_n, L_s, L_q, W_s, W_q$	Introduction to advanced Markovian queueing models	Problems on classification of state of a Markov chain	Nonseries parallel systems	Availability function
	SLO-2	Effective arrival rate and relations among $E(N_s)$, $E(N_q)$, $E(W_s)$ and $E(W_q)$	Bulk input $(M^{[x]}/M/1)$	Stationary and steady state	Problems on nonseries parallel systems	Availability function
S-10	**SLO-1**	Problems on model (M/M/1) : (k/FIFO)	Problems on Bulk input $(M^{[x]}/M/1)$	Problems on stationary and steady state	System with mixed mode failures	Frequency of failures
	SLO-2	Problems on model (M/M/1) : (k/FIFO)	Bulk service $(M/M^{[y]}/1)$	Problems on stationary and steady state	Problem on system with mixed mode failures	Frequency of failures
S-11	**SLO-1**	Problems on model (M/M/1) : (k/FIFO)	Partial-Batch model	Problems on ergodicity using Markov chain	Introduction to fault tree technique	Two unit Parallel system
	SLO-2	Applications of single server model with finite and infinite system capacity,	Problem on Partial-Batch model	Problems on ergodicity and non-ergodicity using Markov chain	Problems on fault tree technique	Two unit Parallel system
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

Learning Resources	1. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw-Hill, 2008. 2. John F Shortle, James M Thompson, Donald Gross, Carl M Harris, Fundamentals of Queueing Theory, John Wiley & Sons, 2018.	3. Trivedi K S, " Probability and Statistics with reliability, Queueing and Computer Science Applications", Prentice Hall of India, New Delhi, 1984. 4. E. Balagurusamy, Reliability Engineering, 9th Edition, Tata McGraw Hill Education Private Limited, New Delhi 2010. 5. L. S. Srinath, Reliability Engineering, 4th Edition, East West Press, 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	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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Course Code	UMA23G06T	Course Name	Cloud Computing	Course Category	G	Generic Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	To understand the concept of cloud computing	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 appreciate the evolution of cloud from the existing technologies																		
CLR-3 :	Understanding the working methodology for various private cloud services																		
CLR-4 :	To study the various working methodology for public clouds																		
CLR-5 :	To study the future directions in cloud computing with cloud security																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Explain the analytic function and its properties	4	85	80	*H*	*H*	*H*	*H*	*M*	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Explain the transformation concepts in complex variables.	4	85	80	*H*	*H*	*M*	*M*	*H*	-	-	-	*H*	-	-	*H*	-	-	-
CLO-3 :	Explain several facts on complex integration	4	85	80	*H*	*M*	*H*	*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.	4	85	80	*H*	*H*	*H*	*M*	*H*	-	-	-	*H*	-	-	*H*	-	-	-
CLO-5 :	Evaluate the different types of real definite integrals and explain the concepts of singularities	4	85	80	*h*	*M*	*H*	*M*	*H*	-	*H*	-	*M*	-	-	*H*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to Cloud Computing	Service Oriented Architecture	Private Cloud Definition	What is Public Cloud	Explain the security concerns in Traditional IT.
	SLO-2	Definition of Cloud	REST and Systems of Systems	Characteristics of Private Cloud	Why Public Cloud	Introduce challenges in Cloud Computing in terms of Application Security
S-2	SLO-1	Evolution of Cloud Computing	Web Services	Private Cloud deployment Models	When to opt for Public Cloud	Server Security
	SLO-2	Underlying Principles of Parallel Computing	PublishSubscribe Model	Private Cloud Vendors	Public Cloud Service Models	Network Security
S-3	SLO-1	Distributed Computing	Basics of Virtualization	Cloud Stack	Public Cloud Vendors	Security reference model, Abuse and Nefarious Use of Cloud Computing

	SLO-2	Cloud Characteristics	Types of Virtualization	Eucalyptus and Microsoft	Architecture – Public	
S-4	**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-5	**SLO-1**	Cloud Architecture	Implementation Levels of Virtualization	Private Cloud – Benefits and Challenges	Offerings (IaaS, PaaS, SaaS)	Insecure Interfaces and APIs
	SLO-2	Business Values: Service Modelling	Virtualization Structures	Need for Privacy	Offerings (IaaS, PaaS, SaaS)	Insecure Interfaces and APIs
S-6	**SLO-1**	Cloud Storage and Cloud Services	Tools and Mechanisms	Private Cloud implementation in Amazon EC2 service	Demonstrating public cloud with AWS	Malicious Insiders, Shared Technology Issues
	SLO-2	Cloud Storage and Cloud Services	Virtualization of CPU	Private Cloud implementation in Amazon EC2 service	Demonstrating public cloud with AWS	Malicious Insiders, Shared Technology Issues
S-7	**SLO-1**	Industrial Applications	Memory – I/O Devices	Comparing Public, Private and Hybrid	Introduction to EC2 and Storage services of AWS	Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile
	SLO-2	Industrial Applications	Memory – I/O Devices	Comparing Public, Private and Hybrid	Introduction to EC2 and Storage services of AWS	Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile
S-8	**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-9	**SLO-1**	Infrastructure as a Service	Cloud Computing Technology, Clients	Examining the Economics of the Private Cloud	Private vs. Public Cloud	Shared security model between vendor and customer in IAAS/PAAS/SAAS
	SLO-2	Infrastructure as a Service	Security	Examining the Economics of the Private Cloud	When to choose	
S-10	**SLO-1**	Platform as a Service	Virtualization Support and Disaster Recovery	Best Practices and Standards	Inter Cloud Resource Management	Implementing security in AWS.
	SLO-2	Platform as a Service	Virtualization Support and Disaster Recovery	Practical Issues	Resource Provisioning	Implementing security in AWS.
S-11	**SLO-1**	Software as a Service	Network and Services	Standards Organizations and Groups	Resource Provisioning Methods	When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment
	SLO-2	Software as a Service	Network and Services	Standards Organizations and Groups	Global Exchange of Cloud Resources	When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment
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

Learning Resources	1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 1st Edition, 2013. 2. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", QUE, 1st Edition, 2008. 3. Judith S. Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, "Cloud Computing For Dummies", For Dummies, 1st Edition, 2010	4. Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing-A Practical Approach", McGraw-Hill Education, 1st Edition, 2009 5. Borko Furht, Armando Escalante, "Handbook of Cloud Computing", Springer, 2010th Edition, 2010. 6. A.Srinivasan, J.Suresh, "Cloud Computing- A Practical approach for learning and implementation 'O' Reilly, Pearson Education, 2014.

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr.V.Muthukumaran,** muthukuv2@srmist.edu.in

Course Code	UMA23P03L	Course Name	Mini Project	Course Category	P	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	4	0	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		
		1	2	3
CLR-1 :	*Produce competent, creative and imaginative graduates with a strong scientific acumen*			
CLR-2 :	*Apply of the acquired knowledge, skills, and tools pertinent to the field of Mathematics*			
CLR-3 :	*Promote independent and collaborative research work in the domain of Mathematics*			
CLR-4 :	*Inculcate the ethical responsibility of the graduate in the scientific society*			
CLR-5 :	*Identify the challenges and solutions pertinent to the field of Mathematics*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Demonstrate the key areas of research*	*4*	*80*	*70*
CLO-2 :	*Develop laboratory and experiment related skills*	*4*	*85*	*75*
CLO-3 :	*Posses' competence on data collection and process of scientific documentation*	*4*	*75*	*70*
CLO-4 :	*Gain the knowledge of research ethics*	*4*	*85*	*80*
CLO-5 :	*Solve problems in their area of research*	*4*	*85*	*75*

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	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 :	*H*	-	-	-	*H*	-	*H*	-	-	-	-	-	-	-	-
CLO-2 :	-	*H*			*H*	*H*	-	-	-	-	-	-	-	-	-
CLO-3 :	-	*M*	-	-	*M*	-	-	-	-	-	*M*	-	-	-	-
CLO-4 :	-	-	-	-	*M*	*M*	-	*H*	-	-	-	-	-	-	-
CLO-5 :	-	-	*H*	-	-	-	*H*	-	-	-	-	*M*	-	-	-

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

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. R. Perumal perumalr@srmist.edu.in

**includes submission of project work in the form of paper for presentation/publication in a conference/journal and/or preliminary filing of a patent with proof.

SEMESTER - VII

Course Code	UMA23117T	Course Name	Functional Analysis	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	*To learn normed spaces and properties*
CLR-2 :	*To understand the properties of linear maps on finite and infinite-dimensional normed spaces*
CLR-3 :	*To understand the significance of inner products on vector spaces*
CLR-4 :	*To learn spectral theorem*
CLR-5 :	*To provide the framework for the theory of harmonic analysis, differential equations, operator theory*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*Appreciate how functional analysis uses and unifies ideas from metric space theory*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Appreciate how useful and powerful are the norm and inner product structures on vector spaces*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Acquainted with the norm and inner product structures, operator norms, dual spaces*	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Understand and apply big three fundamental theorems of functional analysis*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Distinguish the eigenvalues and spectral values of bounded linear operator and the significance of spectral theory.*	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Revision-metric spaces, completeness	Finite-dimensional normed spaces	Duals of sequence spaces	Orthogonal and orthonormal sets,	Eigenvalues of an operator
	SLO-2	Revision- compactness and sequential compactness	Compactness of unit ball	Duals of sequence spaces	Bessel identity	Spectrum of an operator
S-2	SLO-1	Revision- Basis and dimension	Continuous linear maps	Open mapping theorem	Fourier expansion, Parseval formula	Examples of spectrum of operators
	SLO-2	Finite and infinite dimensional vector spaces	Characterizations of continuous linear maps	Problems	Best approximation	Examples of spectrum of operators
S-3	SLO-1	Examples	Examples	Problems	Riesz representation theorem	Examples and properties of finite rank operators

	SLO-2	Examples	Examples	Problems	Riesz representation theorem	Examples and properties of finite rank operators
S-4	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-5	SLO-1	Normed and Banach spaces	Operator norm and properties	Uniform boundedness principle	Adjoint of bounded operators	Compact operators
	SLO-2	Normed and Banach spaces	Operator norm and properties	Uniform boundedness principle	Adjoint of bounded operators	Compact operators
S-6	SLO-1	Examples-K^n, C[a,b]	Examples	Problems	Properties of adjoint	Examples of compact operators
	SLO-2	Holder inequality, Mikowsky inequality	Hahn-Banach theorems	Bounded inverse theorem, two norm theorem	Self-adjoint operators, examples	Properties of compact operators
S-7	SLO-1	l^p-spaces	Hahn-Banach theorems	Inner product spaces, Cauchy-Schwarz inequality	Theorems of self-adjoint operators	Spectrum of compact operators
	SLO-2	Completeness of l^p-spaces	Consequences of Hahn Banach theorems	Example of Hilbert spaces	Normal operators, examples	Properties of spectrum of compact operators
S-8	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-9	SLO-1	Sequence spaces- c,c_0,c_00	Consequences of Hahn Banach theorems	Parallelogram equality, polarization identity	Theorems of normal operators	Fredholm alternatives
	SLO-2	Sequence spaces- c,c_0,c_00	Consequences of Hahn Banach theorems	Parallelogram equality, polarization identity	Theorems of normal operators	Fredholm alternatives
S-10	SLO-1	Completeness of sequence spaces	Dual and double dual	Orthogonal complement	Isometries and unitaries	Spectral theorem for compact self-adjoint operators
	SLO-2	Completeness of sequence spaces	Dual and double dual	Orthogonal complement	Isometries and unitaries	Spectral theorem for compact self-adjoint operators
S-11	SLO-1	Riesz lemma	Canonical embedding of normed spaces	Orthogonal direct sum	Orthogonal projections	Examples
	SLO-2	Riesz lemma	Canonical embedding of normed spaces	Orthogonal direct sum	Orthogonal projections	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

Learning Resources	1. B. V. Limaye. Functional analysis, New age international 2. Rajendra Bhatia. Notes on functional analysis, Hindustan book. 3. M. Fabian, P. Habala, P. Hajek, V.M Santalucia, J. Pelant, V. Zizler. Functional analysis and infinite dimensional geometry, Springer.	4. M. Reed and B. Simmon. Methods of modern mathematical physics, Academic press 5. W. Rudin. Functional analysis, TMH edition

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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. Nirupama Mallick nirupamm@srmist.edu.in

Course Code	UMA23118J	Course Name	Object Oriented Programming in C++	Course Category	C	Discipline Specific Core Course	L	T	P	O	C
							3	0	2	2	4

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
CLR-1 :	To understand the basics of C++ language	
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 relate the concepts of class and object	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 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 :	Identify situations where computational methods and computers would be useful	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Given a computational problem, identify and abstract the programming task involved.	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Approach the programming tasks using techniques learned and write pseudo-code.	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Relating programs on constructor and destructor.	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Choose the right data representation formats based on the requirements of the problem	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Software crisis	Functions	Class and Objects: specifying a class	Constructor and destructor	Inheritance
	SLO-2	Software Evolution	Main functions	Defining member functions	Basic example	Defining derived classes
S-2	SLO-1	Basic concept of OOP	Function Prototyping, call by reference	Making an outside function inline	Constructor, parameterized constructor	Single inheritance
	SLO-2	Benefits of OOP	Return by reference	Nesting and private member functions	Multiple constructors in a class	Making a private member inheritance
S-3	SLO-1	Tokens, Keywords, identifiers and constants	Inline functions, default Arguments	Array within a class	Constructor with default arguments	Multilevel inheritance
	SLO-2	Basic Data types, User defined data types	Const Arguments	Memory allocation for objects	Constructor with default arguments	Multilevel inheritance
S-4	SLO-1	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs
	SLO-2	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs

S-5	**SLO-1**	Basic program	Programs on functions	Practice programs with class	Practice programs in constructors	Practice programs in inheritance
	SLO-2	Basic program	Programs on functions	Practice programs with class	Practice programs in constructors	Practice programs in inheritance
S-6	**SLO-1**	Operators	Function overloading	Static data member	Copy constructor	Multiple inheritances
	SLO-2	scope resolution, member dereferencing, memory management operator	Function overloading	Static member function	Dynamic constructor	Multiple inheritances
S-7	**SLO-1**	Type caste operator, expressions and their types, implicit conversions	Friend and Virtual Functions	Arrays of object	Const object	Hierarchical inheritance
	SLO-2	Operator overloading	Friend and Virtual Functions	Friendly functions	Const object	Hybrid inheritance
S-8	**SLO-1**	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs
	SLO-2	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs
S-9	**SLO-1**	Operator precedence	Practice programs in function overloading	Practice programs in Array-class	Destructor	Practice programs in Multiple, Multilevel inheritance
	SLO-2	Control structure	Practice programs in function overloading	Practice programs in Array-class	Destructor	Practice programs in Multiple, Multilevel inheritance
S-10	**SLO-1**	Practice programs in operators and related topics	Practice programs in function overloading	Practice programs in Array-class	Practice programs in constructor	Practice programs in Multiple, Multilevel inheritance
	SLO-2	Practice programs in operators and related topics	Practice programs in function overloading	Practice programs in Array-class	Practice programs in constructor	Practice programs in Multiple, Multilevel inheritance
S-11	**SLO-1**	Operator precedence	Math library function	Returning objects	Destructor	Nesting of classes
	SLO-1	Control structure	Friend and Virtual Functions	Const member functions	Destructor	Nesting of classes
S-12	**SLO-1**	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs
	SLO-2	Practice Programs	Practice Programs	Practice Programs	Practice Programs	Practice Programs

Learning Resources	1. Ray Lischner, Exploring C++, Springer Science+Business media, New Delhi. 2. P Radha Ganesan, Programming with C++, Sci Tech Publications Pvt. Ltd. 3. John R Hubbard, Atul Kahate, Programming with C++, 3e, Tata MC Graw hill education Pvt. Ltd., New Delhi.	4. B Jarne Stroustrups, Programming Language, AT & T Labs, Murray Hill, New Jersey. 5. E. Balagurusamy, *Programming in ANSI C++*, 4e, Mc Graw-Hill Pvt Ltd, New Delhi.

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%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. M. Suresh** sureshm@srmist.edu.in

Course Code	UMA23D07T	Course Name	Statistics	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	*Understanding the basics of statistics*
CLR-2 :	*Analyzing and summarizing data using measures of central tendency and dispersion*
CLR-3 :	*Learning methods to estimate unknown parameters based on sample data.*
CLR-4 :	*Applying tests of significance for proportions, means, and independence of attributes*
CLR-5 :	*Exploring the relationship between two variables through correlation and regression analysis*

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	PSO -1	PSO -2	PSO-3
CLO-1 :	*Define statistics, use graphical methods for data representation.*	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Analyze data using measures of central tendency and dispersion.*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Estimate population parameters using different methods.*	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Perform hypothesis tests and interpret results.*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Analyze relationships between variables using correlation and regression analysis.*	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module-V (12)
S-1	SLO-1	Meaning and definition of Statistics	Introduction to measures of central tendency	Statistical inference	**Sampling Distributions,** Distributions of sample mean, t, F and chi-square distributions	Bivariate Data
	SLO-2	importance and scope of statistics	Arithmetic Mean	Point estimation	Inter relations between sampling distributions	Correlation using scatter diagram
S-2	SLO-1	functions of statistics and limitations of statistics	Median	Properties of good estimator	Introduction to testing of hypothesis	Correlation and its Properties
	SLO-2	Bar diagrams - simple, component, multiple and percentage	Mode	Unbiasedness	**Large sample test, Test of significance for single proportion**	Karl Pearson's coefficient of correlation
S-3	SLO-1	Component and Multiple bar diagram	Geometric Mean and Harmonic Mean	Consistency and Sufficiency	**Test of significance for difference of proportions**	**Spearman's rank correlation coefficient**
	SLO-2					
S-4	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module-V (12)
S-5	SLO-1	Problems in Bar diagrams	Problems in arithmetic mean, median and mode	Problems in unbiasedness and consistency	**Test of significance for single mean**	Properties of correlation
	SLO-2	Problems in Bar diagrams	Problems in arithmetic mean, median and mode	Problems in unbiasedness and consistency	**Test of significance for difference of means**	Linear regression
S-6	SLO-1	Percentage bar diagram	Problems in HM, GM	Sufficiency and Efficiency	**Small sample tests, Student's t- test for single mean**	Two regression lines
	SLO-2					
S-7	SLO-1	Graphical representations using Histogram	Properties of central tendencies	Problems in Sufficiency and Efficiency	t- test for the difference of means	Identification of regression lines
	SLO-2	Problems in Histogram	Merits and Demerits and problems	Problems in Sufficiency and Efficiency	Paired t test	Properties of regression
S-8	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-9	SLO-1	Frequency curve and frequency polygon	Introduction to Measures of Dispersion and Range, Quartile deviation	Methods of estimation	**F-test for two sample variances**	Linear and nonlinear regression
	SLO-2					
S-10	SLO-1	Problems in Frequency curve and frequency polygon	Mean Deviation	Maximum Likelihood Estimation (MLE)	Chi-square test for goodness of fit	Partial and multiple regression
	SLO-2					
S-11	SLO-1	Representation of frequency distribution using Ogives.	Standard Deviation and Coefficient of variation	Method of Moments Estimator (MME)	Chi-square test for the independence of attributes.	Properties of linear regression
	SLO-2					
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

Learning Resources	1. Gupta, S. C., & Kapoor, V. K. (2020). *Fundamentals of mathematical statistics*. Sultan Chand & Sons.12th edition 2. Gupta, S.C. (2018), Fundamental of Statistics, Himalaya Publishing House, 7th Edition 3. Ross, S. M. (2020). *Introduction to probability and statistics for engineers and scientists*. Academic press.6th Edition 4. Rohatgi, V. K., & Saleh, A. M. E. (2015). *An introduction to probability and statistics*. John Wiley & Sons. 3rd Edition.	5. 4. Gupta, S. P. (2003). *Statistical Methods: Contains, Besides Theory, about 1000 Fully Solved Illustrations and about 1300 Problems with Answers*. Sultan Chand & Sons. 6. Mood, A. M., Graybill, F. A., & Boes, D. C. (2007). Introduction to the Theory of Statistics, 3rd Edn 7. Freund, J. E., Miller, I., & Miller, M. (2004). *John E. Freund's Mathematical Statistics: With Applications*. Pearson Education India..

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. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. R. Varadharajan varadhar@srmist.edu.in

Course Code	UMA23D08T	Course Name	THEORY OF COMPUTATION	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	Introduce the student to the concepts of theory of computation in computer science	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Illustrate finite state machines to solve problems in computing																		
CLR-3 :	Explain the hierarchy of problems arising in computer sciences																		
CLR-4 :	Acquire insights into the relationship among formal languages , formal grammars and Automata																		
CLR-5 :	Familiarize Regular grammars and context free grammars																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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 :	Demonstrate an Understanding of abstract models of computing including deterministic and non-deterministic and turing machine models	4	85	80	H	H	H	H	H	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Demonstrate an Understanding of regular expressions and grammars including context - free and context- sensitive grammars	4	85	80	H	H	M	H	H	-	-	-	-	-	-	H	-	-	-
CLO-3 :	Understand the relation ships between language classes including regular,context-free, context-sensitive and recursively enumerable languages	4	85	80	H	M	H	H	H	-	-	-	-	-	-	H	-	-	-
CLO-4 :	Employ finite state machines for modeling and solving computing problems	4	85	80	H	M	H	H	H	-	-	-	-	-	-	H	-	-	-
CLO-5 :	Design Turing machine	4	85	80	H	M	M	H	H	-		-	-	-	-	H	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Finite Automata-Basic Definitions	Regular Languages and Regular Grammar	Context – Free Grammars	Pushdown Automata	Standard Turing Machine
	SLO-2	Finite Automata-Basic Definitions	Regular Languages and Regular Grammar	Examples of Context – Free Grammars	Definition of Pushdown Automata	Definition of a Turing Machine
S-2	SLO-1	Deterministic Finite Automaton and Languages	Properties of Regular Languages	Leftmost and Rightmost Derivations	Deterministic Pushdown Automata	Turing Machine as Language Accepters
	SLO-2	Deterministic Finite Automaton and Languages	Pumping Lemma for Regular sets	Leftmost and Rightmost Derivations	Deterministic Pushdown Automata	Turing Machine as Transducers

S-3	**SLO-1**	Regular Languages	Pumping Lemma for Regular sets	Derivation Trees	Deterministic Pushdown Automata	Turing Machine as Transducers
	SLO-2	Regular Languages	Closure Properties of Regular Languages	Derivation Trees	Deterministic Pushdown Automata	Turing Machine as Transducers
S-4	**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-5	**SLO-1**	Non- Deterministic Finite Automaton and Languages	Closure Properties of Regular Languages	Method of Transforming Grammars	Pushdown Automata for context – Free languages	Models of Turing Machines
	SLO-2	Non- Deterministic Finite Automaton and Languages	Closure Properties of Regular Languages	Method of Transforming Grammars	Pushdown Automata for context – Free languages	Models of Turing Machines
S-6	**SLO-1**	Non-Deterministic Finite Automaton	Decision Algorithms for regular sets	Method of Transforming Grammars	Context – Free Grammars for Pushdown Automata	Turing machines with more complex storage
	SLO-2	Properties of Non-Deterministic Finite Automaton	Decision Algorithms for regular sets	Method of Transforming Grammars	DerterrrinisticPushdown Autornataand Deterrrfnistir: Context-Fr{lc Lirnglrri;r,g	Turing machines with more complex storage
S-7	**SLO-1**	Equivalence of NFA and DFA	Identifving Nonregular Languages	Method of Transforming Grammars	DerterrrinisticPushdown Autornataand Deterrrfnistir: Context-Fr{lc Lirnglrri;r,g	Non-Deterministic Turing machines
	SLO-2	Equivalence of NFA and DFA	Identifving Nonregular Languages	Chomsky Normal Form	Non-Deterministic Pushdown Automata	Non-Deterministic Turing machines
S-8	**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-9	**SLO-1**	Regular Expressions	Right- anrl Left-Linear Grammars	Relation Between Sentential Fttrms and Derivation Trlees	Non-Deterministic Pushdown Automata	Combining Tlrring Machines for Complicated Tasks
	SLO-2	Regular Expressions	Right- anrl Left-Linear Grammars	Relation Between Sentential Fttrms and Derivation Trlees	Non-Deterministic Pushdown Automata	Combining Tlrring Machines for Complicated Tasks
S-10	**SLO-1**	Regular Languages	Myhill-Nerode theorem	Griebach Normal form	Closure properties of Context – Free languages	Turing machine construction
	SLO-2	Regular Languages	Myhill-Nerode theorem	Griebach Normal form	Closure properties of Context – Free languages	Turing machine construction
S-11	**SLO-1**	Reduction of number of states in Finite Automata	Myhill - Nerode theorem	Griebach Normal form	Closure properties of Context – Free languages	Turing machine construction
	SLO-2	Reduction of number of states in Finite Automata	Myhill - Nerode theorem	Griebach Normal form	Closure properties of Context – Free languages	Turing machine construction
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

Learning Resources	1. John E Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, An Introduction to Automata Theory, Languages and Computation, Second Edition, Pearson –Addison Wesley 2001. 2. Micheal Sisper, Introduction to the theory of computation, Second Edition, Thomson Course Technology, 2006. 3. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata theory and Computation, Pearson Education ,2009	4 Daniel I.A. Cohen, Introduction to computer theory, Second Edition, Wiley Publication , 1996. 5 Peter Linz, An Introduction to Formal Languages and Automata, Fifth Edition, Jones & Bartlett Learning ,2010

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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. Meena Parvathy Shankar,** meenap@srmist.edu.in

Course Code	UMA23G07J	Course Name	PROGRAMMING IN R	Course Category	C	Generic Elective Course	L	T	P	O	C
							3	0	2	2	4

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 :	To understand the basics of R 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 understand Conditional Statements and Loops in R																		
CLR-3 :	To understand the concepts organizing and analyzing data																		
CLR-4 :	To Analyzing numerical data in R																		
CLR-5 :	To understand visualizing and interpreting data through plots																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Learn to use R and R Studio for data analysis.	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	Master decision-making and efficient repetition in R.	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Organize data effectively.	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Proficiency in matrix operations and descriptive statistics	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Perform data visualization and interpret it	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module -I (15)	Module -II (15)	Module -III (15)	Module -IV (15)	Module -V (15)
S-1	SLO-1	Introduction to R:	Conditional Statements in R	Vectors	Basic Matrix Operations	Bar Chart:
	SLO-2					
S-2	SLO-1	R studio, R Script File, Comments Packages In R	Conditional Statements in R	Lists	Basic Matrix Operations:	Pie Chart
	SLO-2					
S-3	SLO-1	Need and Installation of additional packages, checking dependency	Conditional Statements in R	Matrices – Arrays	Determinant and inverse	Boxplot
	SLO-2					
S-4	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2					
S-5	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2					
S-6	SLO-1	Creating Variables in R	Loops in R	Data frames	Eigen values and Eigen vectors	Stem-Leaf plot

Duration (hour)		Module -I (15)	Module -II (15)	Module -III (15)	Module -IV (15)	Module -V (15)
	SLO-2					
S-7	SLO-1	Different data types	Loops in R	Factors	Find rank	Histograms
	SLO-2					
S-8	SLO-1	Different types of operators	Functions in R	Tables	Introduction to descriptive statistics	Scatter Plot
	SLO-2					
S-9	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2					
S-10	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2					
S-11	SLO-1	Basic math	Functions in R	Grouped and Ungrouped Data.	Measures of central tendency	Matrix scatterplot
	SLO-2					
S-12	SLO-1	Sequence and repetition	Importing data to R	Grouped and Ungrouped Data.	Measures of dispersion	Customization and saving
	SLO-2					
S-13	SLO-1	Sorting and lengths	Importing data to R	Grouped and Ungrouped Data.	Correlation	Customization and saving plots
	SLO-2					
S-14	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-1					
S-15	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-1					

Learning Resources	1. Braun, W. J., & Murdoch, D. J. (2021). A first course in statistical programming with R. Cambridge University Press 2. Crawley, M. J. (2012). The R book. John Wiley & Sons 3. Dalgaard, P. (2008). Statics and Computing Introductory Statistics with R. Springer.	4. Gardener, M. (2012). Beginning R: the statistical programming language. John Wiley & Sons 5. Davies, T. M. (2016). The book of R: a first course in programming and statistics. No Starch Press 6. Rizzo, M. L. (2019). Statistical computing with R. CRC Press

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	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	**2. Dr. R. Varadharajan, SRMIST** varadhar@srmist.edu.in

Course Code	UMA23G08J	Course Name	Machine Learning	Course Category	G	General Elective course	L	T	P	O	C
							3	0	2	2	4

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 :	Perceive the importance of Preprocessing Techniques in machine learning
CLR-2 :	Learn the classification Techniques in Machine learning based Statistical method
CLR-3 :	Study the various Classification Techniques in Machine learning based on gradient method
CLR-4 :	Utilize the method of Support vectors and Reinforcement Learning Algorithm to classify the data
CLR-5 :	Learn various types optimization technique in Machine learning

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 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 :	Able to understand the Pre-processing concepts in Machine Learning	4	85	80	H	H	-	-	-	-	H	-	-	-	-	-	-	-	-
CLO-2 :	Understanding Classification Techniques in Machine learning based on Statistical method with working knowledge	4	85	80	H	H	-	-	-	-	H	-	-	-	-	-	-	-	-
CLO-3 :	Gain the working knowledge of classification techniques based on gradient method	4	85	80	H	H	-	-	-	-	H	-	-	-	-	-	-	-	-
CLO-4 :	Able to model the Support vector and Reinforcement Learning Algorithms	4	85	80	H	H	-	-	-	-	H	-	-	-	-	-	-	-	-
CLO-5 :	*Analyze the* various types optimization technique	4	85	80	H	H	-	-	-	-	H	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Real-world problems	Concept Learning	Hebbian Learning	Reinforcement Learning Algorithms	Single Objective Optimization
	SLO-2	Problem formulations (classification and regression).	Supervised and unsupervised learning	Hebbian Learning	Reinforcement Learning Algorithms	Single Objective Optimization
S-2	SLO-1	Mathematical model	Probability Learning	Imbalanced Data	Reinforcement Learning Algorithms	Single Objective Optimization
	SLO-2	Motivation and role of machine learning and problem solving	Bayes' Classification Methods	Single layer Feedforward neural networks	Linear classification method using Support vectors method	Single Objective Optimization

S-3	SLO-1 SLO-2	**Practical: Problem formulations**	**Practical: Bayes' Classification Methods**	**Practical: Single layer Feedforward neural networks**	**Practical: Linear classification method using Support vectors method**	**Practical: Single Objective Optimization**
S-4	SLO-1 SLO-2	**Practical: Problem formulations**	**Practical: Bayes' Classification Methods**	**Practical: Single layer Feedforward neural networks**	**Practical: Linear classification method using Support vectors method**	**Practical: Single Objective Optimization**
S-5	SLO-1	Feature Reduction/Dimensionality reduction	Naïve Bayesian Classification	Multilayer Feedforward neural networks	Support vectors method with kernel function	Pareto model
	SLO-2	Feature Reduction/Dimensionality reduction	Naïve Bayesian Classification	Multilayer Feedforward neural networks	Support vectors method with kernel function	Pareto model
S-6	SLO-1	Principal components analysis (Eigen values, Eigen vectors, Orthogonality)	Naïve Bayesian Classification	Multilayer Feedforward neural networks	Support vectors method with kernel function	Multi Objective Optimization
	SLO-2	Principal components analysis (Eigen values, Eigen vectors, Orthogonality)	Naïve Bayesian Classification	Multilayer Feedforward neural networks	Support vectors method with kernel function	Multi Objective Optimization
S-7	SLO-1 SLO-2	**Practical: Dimensionality reduction**	**Practical: Naïve Bayesian Classification**	**Practical: Multilayer Feedforward neural networks**	**Practical: Support vectors method with kernel function**	**Practical: Multi Objective Optimization**
S-8	SLO-1 SLO-2	**Practical: Dimensionality reduction**	**Practical: Naïve Bayesian Classification**	**Practical: Multilayer Feedforward neural networks**	**Practical: Support vectors method with kernel function**	**Practical: Multi Objective Optimization**
S-9	SLO-1 SLO-2	Data Normalization	Cluster Analysis	Radial Basis function	Random Forests Classification method	Ant colony optimization
S-10	SLO-1 SLO-2	Notion of Training, Validation and Testing(Connect to generalization and over fitting).	K-Means : A Centroid Based Technique	Radial Basis function	Random Forests Classification method	Ant colony optimization
S-11	SLO-1 SLO-1	**Practical: Data Normalization and Training set, Validation set and Testing set**	**Practical: Clustering the data**	**Practical: Radial Basis function**	**Practical: Random Forests Classification method**	**Practical: Ant colony optimization**
S-12	SLO-1 SLO-2	**Practical: Data Normalization and Training set, Validation set and Testing set**	**Practical: Clustering the data**	**Practical: Radial Basis function**	**Practical: Random Forests Classification method**	**Practical: Ant colony optimization**

Learning Resources	1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. 2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. **3.** R NageswaraRao, Core Python Programming, Dream Tech Press, 2017.	4. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011. 5. W J Chun, Core Python Programming, Prentice Hall, 2007. 6. John V Guttag, Introduction to computation and programming, MIT Press, 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	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	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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Course Code	UMA23P04L	Course Name	Internship – III	Course Category	P	*Internship/Apprenticeship / Project/ Community Outreach*	L	T	P	O	C
							0	*0*	*0*	*0*	*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:*
CLR-1 :	*Gain practical experience within the business environment.*
CLR-2 :	*Acquire knowledge of the industry in which the internship is done.*
CLR-3 :	*Apply knowledge and skills learned in the classroom in a work setting*
CLR-4 :	*Develop a greater understanding about career options while more clearly defining personal career goals*
CLR-5 :	*Experience the activities and functions of business professionals.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1 (Level of Thinking (Bloom))	Learning 2 (Expected Proficiency (%))	Learning 3 (Expected Attainment (%))	PLO 1 Fundamental Knowledge	PLO 2 Application of Concepts	PLO 3 Link with Related Disciplines	PLO 4 Procedural Knowledge	PLO 5 Skills in Specialization	PLO 6 Ability to Utilize Knowledge	PLO 7 Skills in Modeling	PLO 8 Analyze, Interpret Data	PLO 9 Investigative Skills	PLO 10 Problem Solving Skills	PLO 11 Communication Skills	PLO 12 Analytical Skills	PLO 13 ICT Skills	PLO 14 Professional Behavior	PLO 15 Life Long Learning
CLO-1 :	*Identify areas for future knowledge and skill development*	*3*	*80*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-2 :	*understanding of what is expected in the job market and what their standard of performance should be*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*Build professional, as well as academic, contacts and begin the process of networking and support for your future careers.*	*3*	*75*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-4 :	*Acquire knowledge of the industry in which the internship is done.*	*3*	*85*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-
CLO-5 :	*practical experience within the business environment*	*3*	*85*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-	-

PROCESS	
Stage I	Identifying area of interest
Stage II	Review I
Stage III	Review II
Stage IV	Review III
Stage V	Final Submission of the Project Report (Thirty pages minimum)

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

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Course Code	UMA23P05L	Course Name	Project Phase-I	Course Category	P	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

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:
CLR-1 :	Produce competent, creative and imaginative graduates with a strong scientific acumen
CLR-2 :	Apply of the acquired knowledge, skills, and tools pertinent to the field of Mathematics
CLR-3 :	Promote independent and collaborative research work in the domain of Mathematics
CLR-4 :	Inculcate the ethical responsibility of the graduate in the scientific society
CLR-5 :	Identify the challenges and solutions pertinent to the field of Mathematics

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)
CLO-1 :	Demonstrate the key areas of research	4	80	70
CLO-2 :	Develop laboratory and experiment related skills	4	85	75
CLO-3 :	Posses' competence on data collection and process of scientific documentation	4	75	70
CLO-4 :	Gain the knowledge of research ethics	4	85	80
CLO-5 :	Solve problems in their area of research	4	85	75

	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
CLO-1	H	-	-	-	H	-	H	-	-	-	-	-	-	-	-
CLO-2	-	H			H	H	-	-	-	-	-	-	-	-	-
CLO-3	-	M	-	-	M	-	-	-	-	-	M	-	-	-	-
CLO-4	-	-	-	-	M	M	-	H	-	-	-	-	-	-	-
CLO-5	-	-	H	-	-	-	H	-	-	-	-	M	-	-	-

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

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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. .Dr. R. Perumal perumalr@srmist.edu.in

**includes submission of project work in the form of paper for presentation/publication in a conference/journal and/or preliminary filing of a patent with proof.

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SEMESTER – VIII

Course Code	UMA23119T	Course Name	Topology	Course Category	C	Discipline Specific Core Course	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	Know about topological spaces, base and subbase.
CLR-2 :	Know about Hausdorff spaces and continuous functions
CLR-3 :	Be familiar with metric topology, product topology, connected spaces, components and path components.
CLR-4 :	Be familiar with compact spaces, local compactness.
CLR-5 :	Exposure to countability and separation axioms.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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
					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 topological structure and its properties	4	85	80	*H*	*L*	-	-	-	-	-	-	*M*	-	-		-	-	-
CLO-2 :	Understand the concept of Hausdorff space and Continuous function.	4	85	80	*H*		-	-		-	*M*	-	*M*	-	-	-	-	-	-
CLO-3 :	Understand the concepts of metric topology, quotient topology, product topology, connectedness and its properties.	4	85	80	*H*	*L*	-	-		-	-	-	*M*	-	-	-	-	-	-
CLO-4 :	Understand the concept of compactness and its properties.	4	85	80	*H*	-	-		*M*	-	-	-	*M*	-	-	-	-	-	-
CLO-5 :	Understand the concept of countability and separation axioms.	4	85	80	*H*		-	-	*H*	-	*H*	-	*M*	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to normed linear space, metric space.	Union of spaces.	Metric topology	Definition and examples of Locally path connected	Applications of limit point in compact space
	SLO-2	ε -δ Definition of continuity, Examples of continuous functions.	Examples	Properties of metric topology	Definition and examples of Locally path connected	Locally compact
S-2	SLO-1	Introduction to point set theory	Closed sets and its properties	Quotient topology	Properties of locally path connected	Properties of locally compact spaces
	SLO-2	Functions and Relations	Examples	Properties of quotient topology	Applications of locally path connected spaces.	Applications of locally compact spaces

S-3	SLO-1	Topological Spaces.	Closure and interior of a set	Connected spaces	Compact Spaces	Countability axioms
	SLO-2	Examples.	Properties based on closure and interior	Examples	Examples	Countability axioms
S-4	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-5	SLO-1	Basis for a topology.	Limit Points and derived sets	Properties of connected spaces	Properties of compact spaces	Properties of Countability
	SLO-2	Examples.	Examples	Applications of connected spaces	Applications of compact spaces	Properties of Countability
S-6	SLO-1	Basis for a topology and its properties.	Hausdorff spaces and its properties	Connected subspaces of the real line	Properties of compact spaces	Separation axioms
	SLO-2	Basis for a topology and its properties.	Examples	Intermediate value theorem	Tube Lemma	Properties of Separation axioms
S-7	SLO-1	Subbasis and its properties.	Continuity of a function	Components, Path components examples	Finite Intersection property, Compact subspace of the real line	Normal Spaces
	SLO-2	Subbasis and its properties.	Examples	Properties of path component	Extreme Value theorem	Examples of Normal Spaces
S-8	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-9	SLO-1	Order topology	Homeomorphisms and its properties	Definition and examples of Locally connected	Lebesgue number lemma	Properties of Normal spaces
	SLO-2	Basis for order topology	Examples	Definition and examples of Locally connected	Uniformly continuous	Applications of normal spaces
S-10	SLO-1	Subspace topology	Construction of continuous function	Properties of locally connected	Properties of Uniform continuity	Urysohn's Lemma
	SLO-2	Examples	Pasting Lemma	Properties of locally connected	Applications of uniform continuity	Proof of Urysohn's Lemma
S-11	SLO-1	Properties of Subspace topology	Product topology, Box topology	Problems on locally connected space	Limit Point compactness	Urysohn Metrization Theorem
	SLO-2	Basis for Subspace topology.	Properties based on product topology	Problems on locally connected space	Properties of limit point compactness	Proof of Urysohn Metrization Theorem
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

Learning Resources	1. James R. Munkres, Topology, PHI Learning Private Limited, Second Edition, 2009. 2. M. A. Armstrong, Basic Topology, Springer, 2005. 3. Bredon, Topology and Geometry, Springer 2010.	4. K. D. Joshi, " Introduction to General Topology", New Age International, New Delhi, Second edition, 2017. 5. G.F. Simmons, Topology and Modern Analysis, Mc Graw-Hill, New York, 13th reprint, 2010.

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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. V. Visalakshi visalakv@srmist.edu.in

Course Code	UMA23120T	Course Name	Time Series Analysis	Course Category	C	Discipline Specific Core Courses	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	Forecast the trend pattern exhibited by the given data by using various methods
CLR-2 :	Run and interpret time series models and regression models for time series
CLR-3 :	Use the Box-Jenkins approach to model and forecast time series data empirically
CLR-4 :	Analyze and estimate the cyclic components using special processes
CLR:5 :	Model time series to analyses the underlying structure(s) in both the time and frequency domains

Learning	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 (%)	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
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	Learn about important time series models and their applications in various fields.	4	85	80	H	-	H	-	-	-	-	-	-	-	-	H	-	-	-
CLO-2 :	Able to formulate real life problems using time series models	4	85	80	H		H	-		-	-	-	-	-	-	-	-	-	-
CLO-3 :	Learn to communicate the statistical analyses of substantial data sets	4	85	80	H	-	H-	-		-	-	-	-	-	-	-	-	-	-
CLO-4 :	Learn to use visual and numerical diagnostics to assess the soundness of their models.	4	85	80	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Able to combine and adapt different statistical models to analyze larger and more complex data.	4	85	80	H		H	-	-	-		-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to times series data	Method of moving averages	Variate component method	Brown's discounted regression	Moving-average (MA) process
	SLO-2	Introduction to times series data	Method of moving averages	Variate component method	Brown's discounted regression	Moving-average (MA) process
S-2	SLO-1	Application of time series	Detrending	Stationary Time series	Box-Jenkins Method	Autoregressive (AR) process of orders one and two,
	SLO-2	Application of time series	Detrending	Stationary Time series	Box-Jenkins Method	Autoregressive (AR) process of orders one and two,

S-3	**SLO-1**	Components of a time series	Effect of elimination of trend on other Components of the time series.	Weak stationary	Deseasonalization	Autoregressive (AR) process of orders one and two,
	SLO-2	Components of a time series	Effect of elimination of trend on other Components of the time series.	Weak stationary	Deseasonalization	Autoregressive (AR) process of orders one and two,
S-4	**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-5	**SLO-1**	Decomposition of time series	Seasonal Component	Autocorrelation function	De seasonalization	Estimation of the parameters of AR (1)
	SLO-2	Decomposition of time series	Seasonal Component	Autocorrelation function	De seasonalization	Estimation of the parameters of AR (1)
S-6	**SLO-1**	Decomposition of time series	Estimation of seasonal component by Method of simple averages	Autocorrelation function	Cyclic Component	Estimation of the parameters of AR (1)
	SLO-2	Decomposition of time series	Estimation of seasonal component by Method of simple averages	correlogram of moving average	Cyclic Component	Estimation of the parameters of AR (1)
S-7	**SLO-1**	Trend: Estimation of trend	Ratio to Trend	correlogram of moving average	Harmonic Analysis	Estimation of the parameters of AR (2)
	SLO-2	Estimation of trend by free hand curve method	Ratio to Trend	Forecasting	Harmonic Analysis	Estimation of the parameters of AR (2)
S-8	**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-9	**SLO-1**	Method of semi averages	Ratio to moving average and Link relatives	Exponential smoothing methods	Harmonic Analysis	Yule-Walker equations
	SLO-2	Method of semi averages	Ratio to moving average and Link relatives	Exponential smoothing methods	Harmonic Analysis	Yule-Walker equations
S-10	**SLO-1**	Ftting various mathematical curve	Ratio to moving average and Link relatives	Exponential smoothing methods	Some Special Processes	Yule-Walker equations
	SLO-2	Fitting various mathematical curve	Ratio to moving average and Link relatives	Exponential smoothing methods	Some Special Processes	Yule-Walker equations
S-11	**SLO-1**	Growth curves	Ratio to moving average and Link relatives	Short term forecasting methods	Some Special Processes	Yule-Walker equations
	SLO-2	Growth curves	Ratio to moving average and Link relatives	Short term forecasting methods	Some Special Processes	Yule-Walker 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

Learning Resources	1. Kendall M.G. (1976): Time Series, Charles Griffin. 2. C Chatfield, C. (1996). *The Analysis of Time Series* , 5th edition, Chapman and Hall, New York. 3. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied	4. Shumway, R.H., Stoffer, D.S. (2006). Time Series Analysis and Its Applications (with R examples) . Springer-Verlag, New York 5. James D. Hamilton (1994). Time Series Analysis , 1st Edition, Princeton University Press,

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. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. P. Sambath, sampathp@srmist.edu.in

Course Code	UMA23D09T	Course Name	OPERATIONS RESEARCH	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	Construct linear programming problem and apply the techniques of simplex method for solving linear programming problems.
CLR-2 :	Apply the concept of various approximation method for the transportation model and assignment models
CLR-3 :	Demonstrate the network techniques in planning and scheduling large projects in various sectors.
CLR-4 :	Relate replacement model and strategic theory and applications.
CLR-5 :	Describes various queuing models and applications.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	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
	Learning	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	*Formulate and solve the Linear programming problem by simplex and graphical techniques.*	4	85	80	*H*	-	-	-	-	-	-	-	-	*H*	-	*H*	-	-	-
CLO-2 :	*Interpret the transportation and assignment problems by approximation techniques.*	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Explain and analyze the networking and scheduling problems in project management.*	4	85	80	*H*	*H*	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Identify the deterioration replacement and apply strategy theory.*	4	85	80	*H*	-	-	*H*	-	-	-	-	-	*M*	-	-	-	-	-
CLO-5 :	Applied queueing model in different scenarios.	4	85	80	*H*	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	Introduction to Linear Programming	Transportation Problem Introduction – MSPT - The Dijkstra algorithm	Project Scheduling Introduction – Network construction	Replacement Model	Queueing theory Introduction
	SLO-2	Formulation of the linear programming problem	Floyd's Algorithm {Shortest Route Algorithm} Mathematical Formulation of Transportation problem	Project Scheduling Introduction – Network construction	Replacement Model	Queueing theory Introduction
S-2	SLO-1	Extension of Sum rule	Generalized Combination	Network and basic components	The first order recurrence relation-An introduction	Basic Definitions with Examples
	SLO-2	Problems by using the extension of sum rule	Problems in Generalized Combination	Rules of network construction	Problems in recurrence relation	Basic Definitions with Examples
S-3	SLO-1	Basic Definitions of solution of LPP	Vogel's approximation and MODI method	CPM and various floats	Game Theory - Two- person zero-sum game. Pure and Mixed strategies. Saddle	Characteristics of Queueing theory

					point and its existence. Fundamental Theorem of Rectangular games. Concept of Dominance. Dominance and Graphical method of solving Rectangular games.	
	SLO-2	Basic Definitions of solution of LPP	Vogel's approximation and MODI method	CPM and various floats	Game Theory - Two- person zero-sum game. Pure and Mixed strategies. Saddle point and its existence. Fundamental Theorem of Rectangular games. Concept of Dominance. Dominance and Graphical method of solving Rectangular games.	Characteristics of Queueing theory
S-4	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-5	SLO-1	Simplex Algorithm	Balanced and Unbalanced Transportation problem	Three time estimates – PERT Algorithm.	Two person zero sum game - Pure and Mixed strategies. Saddle point and its existence.	Model: (M/M/1):(∞/FIFO)
	SLO-2	Simplex Algorithm	Balanced and Unbalanced Transportation problem	Three time estimates – PERT Algorithm.	Two person zero sum game - Pure and Mixed strategies. Saddle point and its existence.	Model: (M/M/1):(∞/FIFO)
S-6	SLO-1	Artificial Variable Technique (Big-M method)	Maximization in Transportation problem	Project Evaluation and Review techniques	The Maxmini – Minimax principle	Model: (M/M/1):(∞/FIFO)
	SLO-2	Artificial Variable Technique (Big-M method)	Maximization in Transportation problem	Project Evaluation and Review techniques	The Maxmini – Minimax principle	Model: (M/M/1):(∞/FIFO)
S-7	SLO-1	Duality	Assignment Problem Introduction and Formulation	Cost Analysis - Crashing Introduction	Concept of Dominance	Model: (M/M/c):(∞/FIFO)
	SLO-2	Duality	Assignment Problem Introduction and Formulation	Cost Analysis - Crashing Introduction	Concept of Dominance	Model: (M/M/c):(∞/FIFO)
S-8	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-9	SLO-1	Duality	Assignment Problem Introduction and Formulation	Cost Analysis - Crashing Introduction	Concept of Dominance	Model: (M/M/1):(N/FIFO)
	SLO-2	Duality	Assignment Problem Introduction and Formulation	Cost Analysis - Crashing Introduction	Concept of Dominance	Model: (M/M/1):(N/FIFO)
S-10	SLO-1	Dual Simplex method	Hungarian Algorithm for solving assignment problem	Crashing the critical path	Domination Property	Model: (M/M/1):(N/FIFO)
	SLO-2	Dual Simplex method	Travelling salesman Problem	Crashing the critical path	Domination Property	Model: (M/M/c):(N/FIFO)
S-11	SLO-1	Dual Simplex method	Hungarian Algorithm for solving travelling salesman problem	Crashing the critical path	Domination Property	Model: (M/M/c):(N/FIFO)
	SLO-2	Dual Simplex method	Hungarian Algorithm for solving travelling salesman problem	Optimum duration and Minimum duration	(2 x n) and (m x 2) – graphical method	Model: (M/M/c):(N/FIFO)

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

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. *H.A. Taha, Operations Research, An Introduction, PHI, 2008 .* 5. *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.

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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. T. Leelavathy, **leelavat@srmist.edu.in**

Course Code	UMA23D10T	Course Name	Combinatorics	Course Category	D	Discipline Specific Elective Course	L	T	P	O	C
							3	1	0	2	4

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 :	To know about permutation and combinations	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 understand about inclusion and exclusion principle																		
CLR-3 :	*To learn about Generating functions*																		
CLR-4 :	*To understand the concepts of Recurrence relations*																		
CLR-5 :	*To know the basic concepts of Graph Theory*																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	To apply the fundamental concepts of combinatorics	4	85	80	*H*	*H*	*H*	*H*	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	To improve the knowledge in inclusion and exclusion principle	4	85	80	*H*	*H*	*H*	*H*		-	-	-	-	-	-	*H*	-	-	-
CLO-3 :	*To apply the concepts of Generating functions*	4	85	80	*H*	-	*H*	-		-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To apply the concepts of Recurrence relations*	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*To apply the concepts of Graph Theory in Network flow*	4	85	80	*H*	*H*	*H*	*H*	-	-		-	-	-	-	*H*	-	-	-

Duration (hour)		Module-I (12)	Module-II (12)	Module-III (12)	Module-IV (12)	Module- V (12)
S-1	SLO-1	The Rule of Sum	Generalized Permutations	Generating Functions-An introduction	Recurrence relation-An introduction	An Introduction of graph 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 graph 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	Basic Definitions with Examples
	SLO-2	Problems by using the extension of sum rule	Problems in Generalized Combination	The reciprocal of the Generating Functions	Problems in recurrence relation	Basic Definitions with Examples
S-3	SLO-1	The Rule of Product	Sequences and selections	Problems in reciprocal of the Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-An introduction	Eulerian Trials , Theorems and Examples

	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-Problems with distinct real roots	Eulerian Trials , Theorems and Examples
S-4	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-5	SLO-1	Problems by using Permutations	Problems in Sequences and selections	Problems in Partition of Integers	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Hamiltonian Chains and Cycles
	SLO-2	Permutations with repetition	The Inclusion-Exclusion Principle	Problems in Partition of Integers in Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Hamiltonian Chains and Cycles
S-6	SLO-1	Problems by using Permutations	Problems in Sequences and selections	Problems in Partition of Integers	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Hamiltonian Chains and Cycles, Theorems
	SLO-2	Permutations with repetition	The Inclusion-Exclusion Principle	Problems in Partition of Integers in Generating Functions	The second order linear homogenous recurrence relation with constant coefficients-Problems with repeated real roots	Hamiltonian Chains and Cycles, Theorems
S-7	SLO-1	Problems by using Combinations	Derangements and Other Constrained Arrangements	Problems in Self-conjugate	The second order linear homogenous recurrence relation with constant coefficients-Problems with complex roots	Diagraphs Basic Definitions and Examples
	SLO-2	Combination with repetition	Mobius function	Euler's Theorem	The second order linear homogenous recurrence relation with constant coefficients-Problems with complex roots	Diagraphs Basic Definitions and Examples
S-8	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-9	SLO-1	Pascal's Identity	The Permanent of a Matrix	Exponential Generating Functions	Towers of Hanoi –An introduction	Eulerian directed Trial, Directed Hamiton Cycle
	SLO-2	Pascal's Identity	The Permanent of a Matrix	Exponential Generating Functions	Towers of Hanoi –An introduction	Eulerian directed Trial, Directed Hamiton Cycle
S-10	SLO-1	Problems by using Pascal's Identity	Problems by using Rook Polynomials, Hit Polynomials	Problems in Exponential Generating Functions	Towers of Hanoi related with recurrence relation-problem	Eulerian directed Trial, Directed Hamiton Cycle
	SLO-2	Problems by using Convolution rule or Vandermonde identity	Catalan Numbers, Difference sequences and stirling Numbers	Dobinski's Equality	The method of generating functions-An introduction	Trading Problem and Examples
S-11	SLO-1	Pigeonhole Principle-Simple form	Partition Numbers, Lattice Path	Bernoulli polynomial	More problems in the method of generating functions	Networks
	SLO-2	Pigeonhole Principle-strong form	Lattice Path, Shcroder Numbers	Problems in Bernoulli polynomial	More problems in the method of generating functions	Max-flow Min-cut Theorem
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

Learning Resources	1. Richard A. Brualdi, Introductory Combinatorics, 4th Edition, Pearson Education and Dorling Kindersley Publishing,2004. 2. Jan Anderson, A First Course in Combinatorial Mathematics, Oxford Applied Mathematics and Computing Science Series, UK, 2013. 3. R.P.Grimaldi, B.V.Ramana, Discrete and Combinatorial Mathematics-An Applied Introduction, 5th Edition, Pearson Education, 2010	4. V.K.Balakrishnan, Combinatorics, Schuam Series, 1996. 5. 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	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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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. **. Dr.S.Sangeetha, SRMIST** sangeets@srmist.edu.in

Course Code	UMA23G09T	Course Name	Stochastic Process	Course Category	G	General Elective course	L	T	P	O	C
							3	1	0	2	4

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 :	Describe the applications on discrete and continuous random variables.	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 :	Assess the applications of two dimensional random variables																		
CLR-3 :	Relate the specialized knowledge in random processes in signals and systems.																		
CLR-4 :	Understand the concept of autocorrelation function																		
CLR-5 :	Determine the applications of spectral density functions																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Compare the fundamentals between discrete and continuous random variables.	4	85	80	*H*	-	*H*	-	-	-	-	-	-	-	-	*M*	-	-	-
CLO-2 :	Choose the model and analyze systems using two dimensional random variables	4	85	80	*H*	*H*	*H*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-
CLO-3 :	Interpret the characteristics of random processes.	4	85	80	*H*	-	*H*	-		-	-	-	-	-	-	-	-	-	-
CLO-4 :	Evaluate the mean and mean square value of a process employing autocorrelation function	4	85	80	*H*	-	*H*	*M*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Evaluate problems on spectral density functions and linear time invariant systems	4	85	80	*H*	*M*	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Types of random variables introduction and examples-	Two-dimensional random variables introduction	Classification of Random processes	Autocorrelation function	Power spectral Density Function
	SLO-2	Types of random variables introduction and examples-	Problems based on two dimensional discrete random variables	Classification of Random processes	Autocorrelation function	Power Spectral Density Function
S-2	SLO-1	Problems based on probability mass function	Problems based on two dimensional discrete random variables	Stationary processes	Properties with proof	Properties
	SLO-2	Problems based on probability mass function	Problems based on two dimensional discrete random variables	Stationary processes	Properties with proof	Properties

Duration (hour)		15	15	15	15	15
S-3	SLO-1	CDF	Two dimensional continuous random variables	Stationary processes	Problems based on Autocorrelation function	Problems based on properties
	SLO-2	CDF	Two dimensional continuous random variables	Stationary processes	Problems based on Autocorrelation function	Problems based on properties
S-4	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-5	SLO-1	Problems based on probability density function	Joint probability density function	Wide Sense Stationery process	Cross correlation function	Problems on Power Spectral Density Function
	SLO-2	Problems based on probability density function	Joint probability density function	Wide Sense Stationery process	Cross correlation function	Problems on Power Spectral Density Function
S-6	SLO-1	CDF of Continuous Random Variable	Problems on marginal probability density function	Wide Sense Stationery process	Cross correlation function	Cross Power Density Spectrum
	SLO-2	CDF of Continuous Random Variable	Problems on marginal probability density function	Wide Sense Stationery process	Properties with proof	Cross Power Density Spectrum
S-7	SLO-1	mean and variance of a continuous random variable	Marginal distribution functions-	Wide Sense Stationery process	Properties with proof	Cross Power Density Spectrum
	SLO-2	mean and variance of a continuous random variable	Marginal distribution functions-	Wide Sense Stationery process	Properties with proof	Cross Power Density Spectrum
S-8	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-9	SLO-1	Problems using the properties of expectation	Cumulative distribution function of (X, Y)	Strict Sense Stationary process	Problems based on Cross correlation	Properties of Cross Power Density Spectrum
	SLO-2	Problems using the properties of expectation	Cumulative distribution function of (X, Y)	Strict Sense Stationary process	Problems based on Cross correlation	Properties of Cross Power Density Spectrum
S-10	SLO-1	Moments	Transformation of two dimensional random variables	Strict Sense Stationary process	Problems based on Cross correlation	Problems based on Cross Power Density Spectrum
	SLO-2	Moments	Transformation of two dimensional random variables	Strict Sense Stationary process	Problems based on Cross correlation	Problems based on Cross Power Density Spectrum
S-11	SLO-1	Functions of Random variable	Transformation of two dimensional random variables	Strict Sense Stationary process	Problems based on Cross correlation	Problems based on Cross Power Density Spectrum
	SLO-2	Functions of Random variable	Transformation of two dimensional random variables	Strict Sense Stationary process	Problems based on Cross correlation	Problems based on Cross Power Density Spectrum

Duration (hour)		15	15	15	15	15
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	1. Trivedi K S, "Probability and Statistics with reliability, Queuing and Computer Science Applications", Prentice Hall of India, New Delhi, 2nd Edition, 2002. 2. Veerarajan T., "Probability statistics and Random Processes", 3rd Edition, Tata McGraw-Hill, New Delhi, 2008. 3. Sivaramakrishna Das P. and Vijayakumari.C, "A text book of Probability and Random Processes", Viji's Academy, 2010.	4. Papoulis, "Probability, Random Variables and Stochastic Processes", 4th Edition, Tata McGraw-Hill, New Delhi, 2002. 5. Sheldon Ross , A First course in Probability, Sixth Edition, 2011 6. Henry Stark, Probability and Random Processes with Applications to Signal Processing, Third Edition, Pearson

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 %	

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Course Code	UMA23G10T	Course Name	Statistical Quality Control	Course Category	G	General Elective Courses	L	T	P	O	C
							3	1	0	2	4

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 :	To get introduced to the theory and concept of control charts	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 familiarize with the limitations and to analyze and compare the various control charts																		
CLR-3 :	To apply and solve problems using the different types of control charts																		
CLR-4 :	To learn the concept behind the types os sampling methods																		
CLR-5 :	To learn the different methods of sampling																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	To understand the purpose and function of statistical quality control	4	85	80	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	To understand the differences between attributes and variable charts	4	85	80	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	To become familiar with the types of control charts	4	85	80	*H*	-	-	-	*M*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	To understand the different types of sampling methods	4	85	80	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	To become familiar with different methods of sampling	4	85	80	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	General theory of control chart	Practical limitations of control charts for variables	The control chart for fraction nonconforming	Concept, advantages and limitations of sampling inspection,	Dodge -Romig system Single sampling
	SLO-2	General theory of control chart	Practical limitations of control charts for variables	The control chart for fraction nonconforming	Concept, advantages and limitations of sampling inspection,	Dodge -Romig system Single sampling
S-2	SLO-1	Definition of control chart, objectives	Comparison of $\overline{X}$ and R chart with P chart	Control chart for nonformities	Concept, advantages and limitations of sampling inspection,	Double sampling
	SLO-2	Definition of control chart, objectives	Comparison of $\overline{X}$ and R chart with P chart	Control chart for nonformities	Concept, advantages and limitations of sampling inspection,	Double sampling
S-3	SLO-1	relationship between $\overline{X}', \sigma'$ and the valu	Control limits on P chart	Control chart for non formities	Sampling methods	Dodge-Roaming sampling plan
	SLO-2					

Duration (hour)		15	15	15	15	15
S-4	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2	Practice	Practice	Practice	Practice	Practice
S-5	SLO-1	basis of subgrouping	Choice between P and nP chart	procedures with constant sample	sampling methods	multiple continuous sampling plans-Lieberman and Soloman plan
	SLO-2					
S-6	SLO-1	control limits, control chart patterns	periodic review and revision of P	procedures with constant sample	producer's risk, consumers risk	multiple continuous sampling plans-Lieberman and Soloman plan
	SLO-2	control limits, control chart patterns	periodic review and revision of P	procedures with constant sample	producer's risk, consumers risk	multiple continuous sampling plans-Lieberman and Soloman plan
S-7	SLO-1	Run sum test	control charts for defects, class A and B defects	procedures with variable sample	producer's risk, consumers risk	Philips standard sampling system.
	SLO-2	Run sum test	control charts for defects, C and class D defects	procedures with variable sample	producer's risk, consumers risk	Philips standard sampling system.
S-8	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2					
S-9	SLO-1	control limit on sigma charts	control charts for defects additional problems	procedures with variable sample	Quality indices for acceptance sampling plans average outgoing quality limit (AOQL)	Philips standard sampling system.
	SLO-2					
S-10	SLO-1	control limit on sigma charts	comparison between attribute and variable charts	procedures with variable sample	Quality indices for acceptance sampling plans average outgoing quality limit (AOQL)	Philips standard sampling system.
	SLO-2					
S-11	SLO-1	revising the control limits	comparison between attribute and variable charts	Demerit systems.	characteristics of OC curve	Philips standard sampling system.
	SLO-2					
S-12	SLO-1	Practice	Practice	Practice	Practice	Practice
	SLO-2	Practice	Practice	Practice	Practice	Practice

Learning Resources	1. Statistical Quality control, M Mahajan, Revised edition, 2007 2. Quality Control and Total quality management, PL Jain, Tata McGraw-Hill Publications, 2001. 3. Introduction to Statistical Quality control, Douglas C. Montgomery, Fourth Edition, John Wiley & sons.	4. Elementary Statistical quality control, John T Burr, Second edition, CRC Press. 5. Statistical quality control and quality management, RC Gupta, Ninth Edition, Khanna Publishers 2014.

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. Madhan Shanmugasundaram, **Infosys Technologies** madshan@gmail.com	**1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras** sryedida@iitm.ac.in	**1. Dr. V. Subburayan, SRMIST** hod.maths.ktr@srmist.edu.in
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Course Code	UMA23P06L	Course Name	Project Phase-II	Course Category	P	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	12	2	6

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		
		1	2	3
CLR-1 :	*Produce competent, creative and imaginative graduates with a strong scientific acumen*			
CLR-2 :	*Apply of the acquired knowledge, skills, and tools pertinent to the field of Mathematics*			
CLR-3 :	*Promote independent and collaborative research work in the domain of Mathematics*			
CLR-4 :	*Inculcate the ethical responsibility of the graduate in the scientific society*			
CLR-5 :	*Identify the challenges and solutions pertinent to the field of Mathematics*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Demonstrate the key areas of research*	*4*	*80*	*70*
CLO-2 :	*Develop laboratory and experiment related skills*	*4*	*85*	*75*
CLO-3 :	*Posses' competence on data collection and process of scientific documentation*	*4*	*75*	*70*
CLO-4 :	*Gain the knowledge of research ethics*	*4*	*85*	*80*
CLO-5 :	*Solve problems in their area of research*	*4*	*85*	*75*

	Program Learning Outcomes (PLO)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	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 :	*H*	-	-	-	*H*	-	*H*	-	-	-	-	-	-	-	-
CLO-2 :	-	*H*			*H*	*H*	-	-	-	-	-	-	-	-	-
CLO-3 :	-	*M*	-	-	*M*	-	-	-	-	-	*M*	-	-	-	-
CLO-4 :	-	-	-	-	*M*	*M*	-	*H*	-	-	-	-	-	-	-
CLO-5 :	-	-	*H*	-	-	-	*H*	-	-	-	-	*M*	-	-	-

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

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
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	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. .Dr. R. Perumal perumalr@srmist.edu.in

**includes submission of project work in the form of paper for presentation/publication in a conference/journal and/or preliminary filing of a patent with proof.

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ALLIED MATHEMATICS

Course Code	UMA23G11T	Course Name	Allied Mathematics	Course Category	G	Generic Elective Course	L	T	P	O	C
							3	1	0	2	4

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:
CLR-1 :	Understand the concept of sets, relations and functions
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

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Acquire the knowledge on sets and functions	3	80	85
CLO-2 :	Gain the ability to identify science and engineering problems logically	1	75	80
CLO-3 :	Understand the basic ideas about polynomial equations	3	85	80
CLO-4 :	Appreciate the concepts of Matrices in real life situations	3	80	75
CLO-5 :	Apply the knowledge of different calculus techniques	1	75	85

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 PSO -1	14 PSO -2	15 PSO-3
CLO-1 :	M	H	-	-		-	-	-	-	-	-	H	-	-	-
CLO-2 :	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	M	-	-	H	-	-	-	-	-	-	-	-	-	-	-

Duration (Hour)		Module 1 (12)	Module 2 (12)	Module 3 (12)	Module 4 (12)	Module 5 (12)
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	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-5	**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-6	**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-7	**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-8	**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-9	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-10	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-11	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
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

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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, Infosys Technologies madshan@gmail.com	1. Dr. Y.V.S.S. Sanyasiraju, IIT Madras sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST hod.maths.ktr@srmist.edu.in
	2. Dr. B. V. Rathish Kumar, IIT Kanpur bvrk@iitk.ac.in	2. Dr. N. Balaji, SRMIST *balajin@srmist.edu.in*

SEMESTER – II

Course Code	UCD23P01L	Course Name	Internship Report– I	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		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 :	Demonstrate skills learnt in the real time environment.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLR-2 :	Explore the different industries that are using IT																		
CLR-3 :	Enhance the skills in the system aspects																		
CLR-4 :	Understanding the professional connections with the knowledge learnt																		
CLR-5 :	Applying the skills in problem solving																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose a company of their own interest for internship for a period of minimum TEN weeks (Part-time) to learn about the application of their related field in real time environment. All students have to give a presentation about their observations made by them in internship as per the schedule given. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the internship period.

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

Course Code	UCD23P02L	Course Name	Project Work – I	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		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 :	Demonstrate skills learnt in the real time environment.																		
CLR-2 :	Explore the different industries that are using IT																		
CLR-3 :	Enhance the skills in the system aspects																		
CLR-4 :	Understanding the professional connections with the knowledge learnt																		
CLR-5 :	Applying the skills in problem solving																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl)	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose problems of their own interest to develop software package using the programming languages/tools available. There will be two reviews conducted during the project period for all the students .At the end of the project, every student shall submit a structured project report and will take a Viva Voce examination.

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

Course Code	UCD23P03L	Course Name	Apprenticeship – I	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		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
CLR-1 :	Demonstrate skills learnt in the real time environment.			
CLR-2 :	Explore the different industries that are using IT			
CLR-3 :	Enhance the skills in the system aspects			
CLR-4 :	Understanding the professional connections with the knowledge learnt			
CLR-5 :	Applying the skills in problem solving			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Disciplinary Knowledge	2 Critical Thinking	3 Problem Solving	4 Analytical Reasoning	5 Research Skills	6 Team Work	7 Scientific Reasoning	8 Reflective Thinking	9 Self-Directed Learning	10 Multicultural Competence	11 Ethical Reasoning	12 Community Engagement	13 ICT Skills	14 Leadership Skills	15 Life Long Learning
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose a company of their own interest for Apprenticeship for a period of minimum TEN weeks (Part-time) to learn about the application of their related field in real time environment. All students have to give a presentation about their observations made by them in internship as per the schedule given. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the internship period.

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

SEMESTER – IV

Course Code	UCD23P04L	Course Name	Internship Report– II	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		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 :	Demonstrate skills learnt in the real time environment.																		
CLR-2 :	Explore the different industries that are using IT																		
CLR-3 :	Enhance the skills in the system aspects																		
CLR-4 :	Understanding the professional connections with the knowledge learnt																		
CLR-5 :	Applying the skills in problem solving																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl)	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose a company of their own interest for internship for a period of minimum TEN weeks (Part-time) to learn about the application of their related field in real time environment. All students have to give a presentation about their observations made by them in internship as per the schedule given. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the internship period.

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

Course Code	UCD23P05L	Course Name	Project Work – II	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

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

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

CLR-1 :	Demonstrate skills learnt in the real time environment.	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Explore the different industries that are using IT																		
CLR-3 :	Enhance the skills in the system aspects																		
CLR-4 :	Understanding the professional connections with the knowledge learnt																		
CLR-5 :	Applying the skills in problem solving																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bl	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1 :	To get an inside view of an industry and organization/company	3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge	3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking	3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition	3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company	3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose problems of their own interest to develop software package using the programming languages/tools available. There will be two reviews conducted during the project period for all the students .At the end of the project, every student shall submit a structured project report and will take a Viva Voce examination.

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

Course Code	UCD23P06L	Course Name	Apprenticeship – II	Course Category	IAPC	Internship/Apprenticeship / Project/ Community Outreach	L	T	P	O	C
							0	0	8	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		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 :	Demonstrate skills learnt in the real time environment.																					
CLR-2 :	Explore the different industries that are using IT																					
CLR-3 :	Enhance the skills in the system aspects																					
CLR-4 :	Understanding the professional connections with the knowledge learnt																					
CLR-5 :	Applying the skills in problem solving																					
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1 :	To get an inside view of an industry and organization/company				3	80	70	L	H	M	H	L	M	L	L	L	L	L	H	M	L	L
CLO-2 :	To gain valuable skills and knowledge				3	85	75	M	H	H	M	L	M	L	L	M	L	L	H	M	L	L
CLO-3 :	To make professional connections and enhance networking				3	75	70	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-4 :	To get experience in a field to allow the student to make a career transition				3	85	80	M	H	M	H	L	M	M	L	M	L	M	H	M	L	L
CLO-5 :	To get an inside view of an industry and organization/company				3	85	75	H	H	M	H	L	M	M	M	M	L	M	M	M	L	L

Students can choose a company of their own interest for Apprenticeship for a period of minimum TEN weeks (Part-time) to learn about the application of their related field in real time environment. All students have to give a presentation about their observations made by them in internship as per the schedule given. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the internship period.

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