

# **SRI KRISHNA ARTS AND SCIENCE COLLEGE**

An Autonomous College Affiliated to Bharathiar University  
Coimbatore - 641008, Tamil Nadu, India.

## **LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**

### **B.Sc. MATHEMATICS**

**for 2022-23 admitted students**

**Amendments (V & VI Semesters)**

### **DEPARTMENT OF MATHEMATICS**



## I. PROGRAMME LEARNING OUTCOMES (PLOs)

No.	The Graduates of B.Sc. Mathematics programme will be able to:
PLO1	Ability to apply <b>knowledge</b> of mathematics to the solutions of complex problems in all fields. ( <b>Critical Thinking</b> ) ( <b>Cognitive</b> )
PLO2	Graduates will equip with skills and knowledge to get employment in industry / institution as well as government departments by imparting the computational skills. ( <b>Cognitive</b> )
PLO3	Graduates will have capability to work in a team to become leaders and entrepreneurs with ethical responsibility. ( <b>Psychomotor</b> )
PLO4	Graduates will be motivated to pursue higher education in various universities across the globe.
PLO5	Imbibe effective scientific and/or technical <b>communication</b> in both oral and writing. ( <b>Affective</b> )
PLO6	To encourage the use of relevant mathematical software's like LaTeX, MATLAB, and further the use of the R-programming, PYTHON to the expectations of Industry 4.0 and 5.0. ( <b>Digital Skills</b> ) ( <b>Affective</b> )
PLO7	An ability to develop and conduct appropriate experimentation, analyze and interpret data by using <b>statistical tools</b> (HOT) ( <b>Cognitive</b> )
PLO8	Demonstrate effective <b>leadership skills</b> to work efficiently in a competitive domestic and global environment. ( <b>Affective</b> )
PLO9	Apply the Mathematical concepts, in all the fields of learning including higher research, and recognize the need and prepare for <b>lifelong learning</b> . ( <b>Affective</b> )
PLO10	Enhance <b>entrepreneurial skills</b> and professional development through consultancy and extension services at a competitive level. ( <b>Affective</b> )
PLO11	Apply <b>ethical</b> principles and commit to professional ethics, responsibilities and norms in the society. ( <b>Affective</b> )

PROGRAMME LEARNING OUTCOMES VS GRADUATE ATTRIBUTES VSTAXONOMY OF VERBS														
PLO	Graduate Attributes											Blooms		
	Knowledge	Critical Thinking	Practical Skills	Team work	Communication skills	Digital skills	Numeracy	Leadership skills	Lifelong learning	Entrepreneurial skills	Ethics & Professionalism	Cognitive	Psychomotor	Affective
1	√											√		
2		√										√		
3			√										√	
4				√										√
5					√									√
6						√								√
7							√					√		
8								√						√
9									√					√
10										√				√
11											√			√

PLO	PEO 1	PEO 2	PEO 3
PLO 1	√		
PLO 2	√		
PLO 3	√		
PLO 4		√	
PLO 5			√
PLO 6	√		
PLO 7			√
PLO 8		√	
PLO 9			√
PLO 10			√
PLO 11		√	

**II. ADDITIONAL PROGRAMME OUTCOMES (APOs)**

<b>APO 1</b>	Graduates will have ability with good IQ and EQ (Intelligent Quotient and Emotional Quotient).
<b>APO 2</b>	Graduates will have an ability to virtually collaborate.
<b>APO 3</b>	Graduates will have an ability to effectively use social media for productive purposes.
<b>APO 4</b>	Graduates will have critical thinking and innovative skills to perform given task in their profession.
<b>APO 5</b>	Graduates will have a good distinct foot print.

**III. PROGRAMME SPECIFIC OUTCOMES (PSO's)**

<b>PSO 1</b>	Understand the concepts and methodologies in the field of mathematical sciences and apply them in Mathematical and Statistical applications such as Business, Scientific Research and Technological Computations.
<b>PSO 2</b>	Apply techniques and tools of computational science to provide real time solutions with latest applications.

**VII. Curriculum Structure for B.Sc. Mathematics****Course Components, Credits & Marks Distribution**

Part No	Group	Basic Structure: Distribution of Courses	Number of Courses	Total Marks	Total Credits
I - IV	1	AEC – Ability Enhancement Courses	10	1000	31
III & IV	2	DSC – Discipline Specific Courses	15	1500	58
	3	DSE – Discipline Specific Electives	9	900	32
	4	GEC – Generic Elective Courses	6	600	19
IV	5	ANCC I & II – Audit Non-Credit Courses	2	-	-
V		ANCC III – Audit Non-Credit Courses	1	Completed	
-	6	DTC – Drive Through Courses (SWAYAM-NPTEL, Coursera, Any courses certified by statutory bodies, etc)	Any number	-	Addl. Credits
<b>Total</b>				<b>4000</b>	<b>140</b>

**Group 1. Ability Enhancement Courses (AECs)(10 Courses)**

AEC are the courses based upon the content that leads to knowledge enhancement. Ability Enhancement Courses (AEC) are the following:

S. No.	Course Code	Course Title	Semester	Ownership Department	Contact Hours	Credits	Marks
1	22AEC02/ 22AEC07/ 22AEC11/ 22AEC17/ 22AEC21/	<b>AEC Part I:</b> Language – I Tamil-I - Tamizhum Ariviyalum / Hindi-I/ French-I/ Malayalam-I Sanskrit – I	I	Language Dept.	6	3	100
2	22AEC26	<b>AEC Part II:</b> English-I: English for Professional Communication	I	English Dept.	6	3	100
3	22AEC04/ 22AEC08/ 22AEC12/ 22AEC18/ 22AEC22	<b>AEC Part I:</b> Language – II Tamil-II - Panpattu Padhivugalum Ariviyalargalum/ Hindi-II/ French-II/ Malayalam-II/ Sanskrit – II	II	Language Dept.	6	3	100
4	22AEC28	<b>AEC Part II:</b> English – II: Campus to Corporate	II	English Dept	6	3	100
5	22AEC32	<b>AEC Part III:</b> Academic Skills for Mathematics	II	Maths Dept	3	3	100
6	22AEC05/ 22AEC09/ 22AEC13/ 22AEC19/ 22AEC23	<b>AEC Part I:</b> Language – III Tamil-III - Kappiyamum Meippadukalum / Hindi-III/ French-III/ Malayalam-III/ Sanskrit – III	III	Language Dept.	6	3	100

7	22AEC29	<b>AEC Part II:</b> English-III: English through Literature	III	English Dept	6	3	100
8	22AEC52	<b>AEC Part III:</b> Capstone Project for Mathematics	III	Maths Dept.	-	4	100
9	22AEC06/ 22AEC10/ 22AEC14/ 22AEC20/ 22AEC24	<b>AEC Part I:</b> Language – IV Tamil-IV - Vazhakkarakalum Urainadaium/ Hindi-IV/ French-IV/ Malayalam-IV/ Sanskrit – IV	IV	Language Dept.	6	3	100
10	22AEC30	<b>AEC Part- II:</b> English-IV: Anthology of Literature	IV	English Dept	6	3	100
<b>Total</b>						<b>31</b>	<b>1000</b>

### Group 2. Discipline Specific Courses (DSCs)(15 Courses)

These courses are to be studied compulsorily by the students as a core requirement. The students are required to take DSCs across six semesters. The courses designed under this category aim to cover the basics that a student is expected to imbibe in the particular discipline. It includes Major project.

S. No.	Course Code	Course Title	Semester	Contact Hours	Credits	Marks
1	22MAU01	<b>DSC 1:</b> Classical Algebra	I	4	4	100
2	22MAU02	<b>DSC 2:</b> Calculus	I	4	4	100
3	22MAU05	<b>DSC 3:</b> Analytical Geometry and Vector Calculus	II	5	4	100
4	22MAU08	<b>DSC 4:</b> Trigonometry and Fourier Series	III	4	4	100
5	22MAU09	<b>DSC 5:</b> Differential Equations and Laplace Transforms	III	4	3	100
6	22MAU10	<b>DSC 6:</b> Statics	III	3	3	100
7	22MAU11	<b>DSC 7:</b> Abstract Algebra	IV	5	4	100
8	22MAU12	<b>DSC 8:</b> Dynamics	IV	4	4	100
9	22MAU18	<b>DSC 9:</b> Real Analysis	V	6	4	100

10	22MAU19	<b>DSC 10:</b> Special Functions	V	6	4	100
11	22MAU20	<b>DSC 11:</b> Number Theory	V	5	4	100
12	<b>22MAU25</b>	<b>DSC 12:</b> Linear Algebra	VI	6	4	100
13	<b>22MAU26</b>	<b>DSC 13:</b> Complex Analysis	VI	5	4	100
14	<b>22MAU27</b>	<b>DSC 14:</b> Graph Theory	VI	5	4	100
15	<b>22MAU32</b>	<b>DSC 15:</b> Major Project	VI	6	4	100
Total					<b>58</b>	<b>1500</b>

### Group 3. Discipline Specific Elective (DSEs) (9 Courses)

Discipline Specific Elective courses offered under the main discipline of study which may be specialized or advanced or supportive to the discipline of study. Students can choose any NINE courses from the following list.

S. No.	Course Code	Course Title	Ownership Department	Semester	Contact Hours	Credits	Marks
1	22MAU03A	<b>DSE1:</b> Mathematical Statistics-I	Mathematics	I	3	2	50
	22MAU03B	<b>DSE 1:</b> Practical Mathematical Statistics - I			2	2	50
	22MAU04	<b>DSE 1:</b> Operations Research – I			5	4	100
2	22MAU06A	<b>DSE 2:</b> Mathematical Statistics- II	Mathematics	II	3	2	50
	22MAU06B	<b>DSE 2:</b> Practical Mathematical Statistics- II			2	2	50
	22MAU07	<b>DSE 2:</b> Operations Research – II			5	4	100
3	22MAU13	<b>DSE 3:</b> Mathematical Ethics and Professional Values	Mathematics	IV	3	3	100
	22MAU14	<b>DSE 3:</b> Mathematical Biology					
	22MAU15	<b>DSE 3:</b> Statistical Techniques and Time Series for Data Analytics					
4	22MAU16	<b>DSE 4:</b> Industrial Exposure Training	Mathematics	V	4 weeks	5	100
	22MAU17A	<b>DSE 5:</b> Introduction to MATLAB	Mathematics	V	3	2	50
	22MAU17B	<b>DSE 5:</b> Practical – Computational Mathematics			2	2	50

6	22MAU21	DSE 6: Essential Mathematics for Machine Learning	Mathematics	V	5	4	100
	22MAU22	DSE 6: Introduction to Industry 4.0					
7	22MAU23	DSE 7: Practical - LaTeX	Mathematics	V	3	3	100
	22MAU24	DSE 7: Practical - Computational Mathematics using SymPy					
8	22MAU28	DSE 8: Practical – Data Analysis using Python	Mathematics	VI	3	2	100
	22MAU29	DSE8: Practical –Data Analysis using R Programming					
9	22MAU33	DSE 9: Numerical Methods	Mathematics	VI	5	3	100
	22MAU34	DSE 9: Discrete Mathematics					
	Total					32	900

### Industrial Exposure Training (IET):

Students can opt for Industrial Exposure Training during fifth semester for a period of 4 weeks, in such case one DSE course will be exempted.

The Continuous Internal Assessment mark distribution for IET is as follows:

Component	Mode of Conduct	Project Coverage	Marks
3 Reviews	Presentation	Phase by Phase	25
Work Diary	Written	Phase by Phase	10
Report	Submission	Entire Process	15
Total			50

Viva-voce Marks for the Industrial Exposure Training will be given based on the report and viva-voce examination, conducted by the Department.

**Report : 30 Marks**

**Viva-voce: 20 Marks**



### Major Project

During the Sixth semester each student should undertake a project work and submit the report. A guide will be allotted to each student by the Department. A student can select any research topic in discussion with the guide. The project report will be evaluated jointly by the internal and external examiners for **50 Marks** and Viva-voce examination shall be conducted jointly for **50 Marks**.

Three Reviews should be conducted and marks have to be entered in My classroom portal as follows:

<b>Review</b>	<b>– 25 Marks</b>
<b>Work Dairy</b>	<b>– 10 Marks</b>
<b>Report</b>	<b>– 15 Marks</b>
<b>Total</b>	<b>– 50 (Internal) Marks</b>

**End Semester Viva-Voce will be conducted for 50 (External) Marks.**

**(Dissertation - 30 Marks & Viva-voce - 20 Marks)**

### Group 4. Generic Elective Courses (GECs) (5 Courses)

Generic Elective Courses are interdisciplinary in nature. They are additional courses based on expertise, specialization, requirements, scope, and need of the department. The student has to subscribe any 5 courses in the following list:

Sl. No.	Course Code	Course Title	Semester	Ownership Department	Contact Hours	Credits	Marks
1	22GEU32A	Programming in C++	I	Computer Applications	3	2	50
	22GEU32B	Programming in C++ Lab			2	2	50
	22GEU33	Introduction to Data Structure			5	4	100
2	22GEU34A	Java Programming	II	Computer Applications	3	2	50
	22GEU34B	Java Programming Lab			2	2	50
	22GEU35	Introduction to Computer Networks			5	4	100
3	22GEU36A	Python Programming	III	Computer Applications	2	2	100
	22GEU36B	Python			2	2	

		Programming Lab					
	22GEU37A	Database Management System			2	2	50
	22GEU37B	Database Management System Lab			2	2	50
4	22GEU06	Business and Entrepreneurial English					
	22GEU07	English for Research Writing	III	English	3	3	100
	22GEU08	English for Persuasive Communication					
5	22GEU01	Spoken Hindi					
	22GEU02	Spoken Tamil					
	22GEU03	Spoken Telugu	IV	Language Dept.	3	2	100
	22GEU04	Spoken Malayalam					
	22GEU05	Spoken French					
6	22GEU09	Talent Enhancement Course: Aptitude and English for Competitive Examination	IV	English and Maths Dept	3	2	100
<b>Total</b>						<b>19</b>	<b>600</b>

#### Group 5. Audit Non-Credit Courses (ANCC)

Non-Credit Courses are intended for students who want to gain general knowledge, learn a new skill, upgrade existing skills, enrich their understanding of a wide range of topics, or develop personal interests. A student has to complete any two courses during Semester I and II.

Part IV - ANCC		
S. No.	Course Code	Course Name
<b>Semester I - ANCC 1</b>		
1.	22ANC01	Environmental Studies
<b>Semester II - ANCC 2 - Values &amp; Ethics</b>		
2.	22ANC02	Human Rights
3.	22ANC03	Women's Rights
4.	22ANC04	Yoga for Human Excellence

5.	22ANC05	Indian Culture and Heritage
6.	22ANC06	Introduction to Cyber Security
7.	22ANC07	Consumer Protection
8.	22ANC08	Constitution of India
9.	22ANC09	Waste Management

Student has to take part in any one extension activity during their course of study.

Part V - ANCC 3 - Extension Activities		
S. No.	Course Code	Course Name
1.	22ANC10	National Service Scheme
2.	22ANC11	National Cadet Corps
3.	22ANC12	Youth Red Cross
4.	22ANC13	Red Ribbon Club
5.	22ANC14	Rotaract Club
6.	22ANC15	Sports
7.	22ANC16	Association Activities
8.	22ANC17	Club Activities

#### Group 6.

##### i) Drive-Through Course (DTC) I & II– Additional Credits

These courses are intended to bring out and promote the self-learning initiative of the students – where their own motivation is what drives them to complete the course and not external compulsions. This fosters the habit of keeping oneself updated always by means of self-study. It gives opportunities to the students to explore new areas of interest and earn additional credits. Students can take any number of courses under this cafeteria system. The credits will not be taken for CGPA calculation. Additional 4 credits per Course will be given on submission of certificate.

1. SWAYAM-NPTEL
2. Coursera
3. Any courses certified by statutory bodies.

##### ii) Drive-Through Course (DTC – III) – To be Completed

##### Internship Training/Mini Project/ Spoken Tutorial/Economic Talent test etc.

Students individually or with the maximum of four members per batch should take up either Internship training or mini project for a period of fifteen days during IV Semester vacation. The report will be evaluated and viva-voce examination will be conducted during 5<sup>th</sup> semester.

Otherwise, the students have to complete one spoken tutorial course or any certification course suggested by the department.

### VIII. Semester-wise Scheme

Semester I										
Course Code	Course Title	T/P/E	ESE Dur. Hrs	Ins. Hrs/Week	CIA Marks	ES Marks	Total Marks	Credits	SD/EM/EN	G/L/R/N
22AEC02/ 22AEC07/ 22AEC11/ 22AEC17/ 22AEC21	<b>AEC PART I:</b> <b>Language I:</b> Tamil-1- Tamizhum Ariviyalum / Hindi - I/ French-I/ Malayalam-I Sanskrit – I	T	3	6	50	50	100	3	SD	R/ N/ G/ R/ N
22AEC26	<b>AEC PART II:</b> <b>English I:</b> English for Professional Communication	T	3	6	50	50	100	3	EM	G
22MAU01	<b>DSC1:</b> Classical Algebra	T	3	4	50	50	100	4	SD	G
22MAU02	<b>DSC 2:</b> Calculus	T	3	4	50	50	100	4	SD	G
22MAU03A	<b>DSE 1:</b> Mathematical Statistics – I	E	3	3	25	25	50	2	EM	G
22MAU03B	<b>DSE 1:</b> Practical Mathematical Statistics – I			2	25	25	50	2	EM	G
22MAU04	<b>DSE 1:</b> Operations Research – I			5	50	50	100	4	EM	G
22GEU32A	<b>GEC 1:</b> Programming in C++	E	3	3	25	25	50	2	EM	G
22GEU32B	Programming in C++ Lab		3	2	25	25	50	2	EM	G
22GEU33	<b>GEC 1:</b> Introduction to Data Structure	T	3	5	50	50	100	4	EM	G
<b>DTC - I - Additional Credit Courses (NPTEL/Coursera)</b>								4		
22ANC01	<b>ANCC-1 (NF2F)</b> <b>Environmental Studies</b>	T	2	-	-	-	Completed			
<b>Total</b>				<b>30+</b>			<b>600</b>	<b>22 + 4</b>		

			2							
<b>Semester II</b>										
Course Code	Course Title	T/P/E	ESE Dur. Hrs	Ins. Hrs/Week	CIA Marks	ES Marks	Total Marks	Credits	SD/EM/EN	G/L/R/N
22AEC04/ 22AEC08/ 22AEC12/ 22AEC18/ 22AEC22	<b>AEC - PART I : Language II:</b> Tamil-II - Panpattu Padhivugalum Ariviyalargalum/ Hindi-II/ French-II/ Malayalam-II/ Sanskrit – II	T	3	6	50	50	100	3	SD	L
										R
										N
										G
										R
										N
22AEC28	<b>AEC - PART II:</b> <b>English II :</b> Campus to Corporate	T	3	6	50	50	100	3	EM	G
22AEC32	<b>AEC Part III:</b> Academic Skills for Mathematics	T	3	3	50	50	100	3	SD	G
22MAU05	<b>DSC 3:</b> Analytical Geometry and Vector Calculus	T	3	5	50	50	100	4	SD	G
22MAU06A	<b>DSE 2:</b> Mathematical Statistics- II	E	3	3	25	25	50	2	EM	N
22MAU06B	<b>DSE 2:</b> Practical - Mathematical Statistics- II			2	25	25	50	2	EM	N
22MAU07	<b>DSE 2:</b> Operations Research – II	T		5	50	50	100	4	EM	G
22GEU34A	<b>GEC 2 :</b> Java Programming	E	3	3	25	25	50	2	EM	G
22GEU34B	<b>GEC 2 :</b> Java Programming Lab			2	25	25	50	2		
22GEU35	<b>GEC 2 :</b> Introduction to Computer Networks		3	5	50	50	100	4	EM	G
<b>DTC II : Additional Credit Courses (NPTEL/Coursera)</b>								4		
22ANC02	<b>ANCC-2 (NF2F)</b> <b>Value &amp; Ethics:</b>	T	2	-	-	-	Completed			

	<b>HUMAN RIGHTS</b>									
<b>Total</b>				<b>30+ 2</b>			<b>600</b>	<b>21 +4</b>		
<b>Semester III</b>										
<b>Course Code</b>	<b>Course Title</b>	<b>T/ P/ E</b>	<b>ESE Dur. Hrs</b>	<b>Ins. Hrs/ Week</b>	<b>CIA Marks</b>	<b>ES Marks</b>	<b>Total Marks</b>	<b>Credits</b>	<b>SD/ EM/ EN</b>	<b>G/L/R/ N</b>
22AEC05/ 22AEC09/ 22AEC13/ 22AEC19/ 22AEC23	<b>AEC Part I:</b> Language – III Tamil-III – Kappiyamum Meippadukalum / Hindi-III/ French-III/ Malayalam-III/ Sanskrit – III	T	3	6	50	50	100	3	SD	
										L
										R
										N
										G
	R									
22AEC29	<b>AEC Part II:</b> English-III: English through Literature	T	3	6	50	50	100	3	EM	N
22AEC52	<b>AEC Part III</b> Capstone Project for Mathematics	T	3	-	50	50	100	4	EN	N
22MAU08	<b>DSC 4:</b> Trigonometry and Fourier Series	T	3	4	50	50	100	4	SD	G
22MAU09	<b>DSC 5:</b> Differential Equations and Laplace Transforms	T	3	4	50	50	100	3	SD	G
22MAU10	<b>DSC 6:</b> Statics	T	3	3	50	50	100	3	SD	G
22GEU36A	<b>GEC 3:</b> Python Programming	E	3	2	25	25	50	2	EM	G
22GEU36B	<b>GEC 3:</b> Python Programming Lab		3	2	25	25	50	2		
22GEU37A	Database Management System	E	3	2	25	25	50	2	EM	G
22GEU37B	Database Management System Lab		3	2	25	25	50	2		
22GEU06	<b>GEC 4:</b> Business and Entrepreneurial English	T	3	3	50	50	100	3	SD	G
<b>Total</b>				<b>30</b>			<b>800</b>	<b>27</b>		

Semester IV											
Course Code	Course Title	T/ P/ E	ESE Dur. Hrs	Ins. Hrs/ Week	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	G/L/R/ N	
22AEC06/ 22AEC10/ 22AEC14/ 22AEC20/ 22AEC24	<b>AEC Part I:</b> Language – IV Tamil-IV – Vazhakkarukalum Urainadaium / Hindi-IV/ French-IV/ Malayalam-IV/ Sanskrit – IV	T	3	6	50	50	100	3	SD	L	
										R	
										N	
										G	
										R	
										N	
22AEC30	<b>AEC Part- II:</b> English-IV: Anthology of Literature	T	3	6	50	50	100	3	EM	G	
22MAU11	<b>DSC 7:</b> Abstract Algebra	T	3	5	50	50	100	4	SD	G	
22MAU12	<b>DSC 8:</b> Dynamics	T	3	4	50	50	100	4	SD	G	
22MAU13	<b>DSE 3:</b> Mathematical Ethics and Professional Values	T	3	3	50	50	100	3	EN	G	
22MAU14	<b>DSE 3:</b> Mathematical Biology										
22MAU15	<b>DSE 3:</b> Statistical Techniques and Time Series for Data Analytics										
22GEU01 22GEU02 22GEU03 22GEU04 22GEU05	<b>GEC 5:</b> Spoken Hindi/ Spoken Tamil/ Spoken Telugu/ Spoken Malayalam/ Spoken French	T	3	3	100	-	100	2	SD	L	
										N	
										R	
										R	
										G	
22GEU09	<b>GEC 6:</b> <b>Talent Enhancement Course :</b> Aptitude and English for Competitive Examinations	T	3	3	50	50	100	2	EM	G	
Total				30			700	21			

Semester V											
Course Code	Course Title	T/ P/ E	ESE Dur. Hrs	Ins. Hrs/ Week	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	G/L/R/ N	
22MAU16	DSE 4:Industrial Exposure Training	-	3	4 Weeks	50	50	100	5	EM/ EN	N	
AND											
22MAU17A	DSE 5: Introduction to MATLAB	E	3	3	25	25	50	2	SD	G	
22MAU17B	DSE 5: Practical – Computational Mathematics			2	25	25	50	2	SD	G	
22MAU18	DSC 9: Real Analysis	T	3	6	50	50	100	4	SD	G	
22MAU19	DSC 10: Special Functions	T	3	6	50	50	100	4	SD	G	
22MAU20	DSC 11: Number Theory	T	3	5	50	50	100	4	SD	G	
22MAU21	DSE 6: Essential Mathematics for Machine Learning	T	3	5	50	50	100	4	EM	G	
22MAU22	DSE 6: Introduction to Industry 4.0								EM	G	
22MAU23	DSE 7: Practical - LaTeX	P	3	3	50	50	100	3	EM	G	
22MAU24	DSE 7: Practical – Computational Mathematics using SymPy										
Course Code by the Department	Drive Through Course III – Internship/ Mini Project/ Spoken Tutorial	Completed									
Total				30			700	28			
Semester VI											
Course Code	Course Title	T/ P/ E	ESE Dur. Hrs	Ins. Hrs/ Week	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	G/L/R/ N	



22MAU25	DSC 12: Linear Algebra	T	3	6	50	50	100	4	SD	G
22MAU26	DSC 13: Complex Analysis	T	3	5	50	50	100	4	SD	G
22MAU27	DSC 14: Graph Theory	T	3	5	50	50	100	4	SD	G
22MAU28	DSE 8: Practical – Data Analysis using Python	P	3	3	50	50	100	2	SD	G
22MAU29	DSE8: Practical – Data Analysis using R Programming									
22MAU30	DSE 9: Numerical Methods	T	3	5	50	50	100	3	EM	G
22MAU31	DSE 9: Discrete Mathematics	T								
22MAU32	DSC 15: Major Project	-	3	6	50	50	100	4	EM	G
22ANC10/ 22ANC11/ 22ANC12/ 22ANC13/ 22ANC14/ 22ANC15/ 22ANC16/ 22ANC17	ANCC 3:Extension Activities National Service Scheme/ National Cadet Corps/ Youth Red cross/ Red Ribbon Club/ Rotaract Club/ Sports/ Association Activities/Club Activities	-	-	-	-	-	Completed	-	-	-
<b>Total</b>				<b>30</b>			<b>600</b>	<b>21</b>		
<b>Total</b>							<b>4000</b>	<b>140</b>		
<b>Drive-Through Course (DTC):</b> Courses offered in SWAYAM-NPTEL, Coursera OR Any courses certified by statutory bodies.			Additional 4 credits per Course will be given on submission of Certificate				During Semester I to Semester VI			

The courses focuses the following needs :				
Needs	G- Global	N - National	R-Regional	L-Local
SD	Skill Development			
EM	Employability			
EN	Entrepreneurship			

**Semester-wise Distribution of Marks and Credits:**

Semester	Total Marks	Total Credits
I	600	22+4
II	600	21+4
III	800	27
IV	700	21
V	700	28
VI	600	21
<b>Total</b>	<b>4000</b>	<b>140+8</b>

- **Amendments in 2022 Batch B.Sc. Mathematics Program**
- The following are the **Changed courses** for 2022 Batch B.Sc Mathematics Program.
  - **Changed course**

S. No.	Course Title	Changed Course Title	Semester
1	Number Theory with SageMath	Number Theory	V
2	Numerical Methods-I/Discrete Mathematics-I	Numerical Methods/Discrete Mathematics	VI
3	Numerical Methods-II/Discrete Mathematics -II		

- The following are the **Renamed Courses** for 2022 Batch B.Sc Mathematics Program.

S. No.	Course Title	Renamed Course Title
1	Number Theory with SageMath	Number Theory
2	Practical - Number Theory with SageMath	
3	Linear Regression Analysis and Forecasting	Practical – Data Analysis using Python
4	Advanced Statistical Analysis with R Programming	Practical –Data Analysis using R Programming
5	Practical - Advanced Statistical Analysis with R Programming	

- The following are the **Dropped courses** for 2022 Batch B.Sc. Mathematics Program.

S. No.	Course Title	Semester	Reason
1	Astronomy	VI	

- The following are the changes in **course code, contact hours and credit** for 2022 Batch B.Sc Mathematics Program (V and VI Semester)

Course Title	Course Code	New Course Code	Changes in contact hours		Changes in credit values	
			From	To	From	To
Introduction to MATLAB	22MAU17A	-	-	-	3	2
Real Analysis	22MAU18	-	5	6	-	-
Special Functions	22MAU19	-	5	6	-	-
Essential Mathematics for Machine Learning/ Introduction to Industry 4.0	22MAU23/ 22MAU24	22MAU21/ 22MAU22	4	5	3	4
Practical -LaTeX/ Practical – Computational Mathematics using SymPy	22MAU25/ 22MAU26	22MAU23/ 22MAU24	-	-	-	-
Linear Algebra	22MAU27	22MAU25	-	-	-	-
Complex Analysis	22MAU28	22MAU26	-	-	-	-
Graph Theory	22MAU29	22MAU27	-	-	-	-
Major Project	22MAU35	22MAU32	-	-	-	-

1	Name of the Course	Theory – Introduction of MATLAB Practical – Computational Mathematics	
2	Course Code	22MAU17A – Theory 22MAU17B – Practical	
3	Course Type	Embedded	Focus On – Skill Development
4	Synopsis/Rationale of the Module	This course enables the student to understand the basic theory concepts and provide programming knowledge on MATLAB.	
5	Semester and Year Offered	V Sem; Year III	
6	Credit Value	4	
7	Pre-requisite (if any)	Knowledge in basic concepts in mathematics.	
8	Assessment Strategy	50% External and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:			
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>
	<b>CLO 1</b>	Interpret arithmetic operations and scalars in MATLAB.	C3 (Apply)	Lecture/Tutorial
	<b>CLO2</b>	Study the concepts of creating arrays and mathematical operations with arrays as an poster presentation and paper presentation	A3 (Valuing)	Case Study assignment / Group Discussion
	<b>CLO 3</b>	Illustrate the main results and their applications	C4 (Analyse)	Lecture/Tutorial
	<b>CLO4</b>	Analyse the applications in numerical analysis as assignment.	A4 (Organizing values)	Case study assignment/Group discussion
	<b>CLO 5</b>	Construct matrix and how to solve system of equations using by various numerical methods.	P3 (Guided Response)	Practical/ Demonstration
				<b>Mode of Assessments</b>
				<b>CIA &amp; FINAL EXAM</b>
				1. Poster Presentation 2.Paper presentation
				<b>CIA &amp; FINAL EXAM</b>
				3.Project report 4.Digital report 5.Assignment
				Practical Tests, Computer Simulations, and Record

10	Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Lifelong Learning skill; PLO 9; CLO 3 – Practical Skills – PLO 3)											
	CLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
	CLO 1											
	CLO 2					✓						
	CLO 3							✓				
	CLO 4						✓					
	CLO 5			✓								

<b>11</b>	<b>Transferable skills</b>	1	Knowledge
		2	Communication skill
		3	Numeracy skill
		4	Digital skill
		5	Practical skill

12	Distribution of Student Learning Time-( <b>*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,</b> ) <b>** F2F-Face to Face; NF2F-Non Face to Face.</b>									
	Course Content outline	CLO	Teaching-Learning Activities							SLT
			Guided Learning (F2F)				E-Learning	Independent Learning (NF2F)		
			L	T	P	O			Total	
Unit I	<b>Starting with MATLAB</b> <ul style="list-style-type: none"><li>• MATLAB windows, Arithmetic operations with scalars</li><li>• Display Formats</li><li>• Elementary math built in functions</li><li>• Scalar variables</li><li>• Command for managing variables</li></ul>	CLO 1	3	2	-	-	5		3	8
Unit II	<b>Creating Arrays</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Variables in MATLAB</li><li>• Transpose Operator</li></ul>		3	2	-	-	5	-	3	8

	<ul style="list-style-type: none"> <li>• Array addressing</li> <li>• Adding, Deleting Elements</li> <li>• Built in function for handling arrays</li> <li>• Strings and Strings as variables</li> </ul>									
<b>Unit III</b>	<b>Mathematical Operation with Arrays</b> <ul style="list-style-type: none"> <li>• Addition, Subtraction, Multiplication and Division of array</li> <li>• Element by element operation</li> <li>• Random numbers</li> </ul>		4	3	-	-	7	-	4	11
	Study the concepts of creating arrays and mathematical operations with arrays as an poster presentation and paper presentation	<b>CLO 2</b>	-	-	-	2	2	-	-	2
<b>Unit IV</b>	<b>Script Files</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Creating, Saving and Running the script files</li> <li>• Global variables</li> <li>• Input and Output commands</li> </ul>	<b>CLO 3</b>	-	4	-	2	6	-	3	9
<b>Unit V</b>	<b>Application in Numerical Analysis</b> <ul style="list-style-type: none"> <li>• Solving an equation with one variable</li> <li>• Finding a minimum or a maximum of a function</li> <li>• Numerical integration, ordinary differential equation</li> </ul>	<b>CLO 3</b>	-	4	-	2	6	-	3	9

	Construct matrix and how to solve system of equations using by various numerical methods.	<b>CLO 4</b>	-	-	-	2	2	-	-	2
<b>Exp 1</b>	MATLAB environment with simple exercises to familiarize command Window, History, Workspace, Current Directory, Figure Window, Edit Window, Shortcuts, Help files.	<b>CLO 5</b>	-	-	2	-	2	-	2	4
<b>Exp 2</b>	Basic operations-Finding roots of a quadratic polynomial using inbuilt code using Formula		-	-	2	-	2	-	2	4
<b>Exp 3</b>	Finding roots and plotting a quadratic, cubic and fourth degree polynomial		-	-	2	-	2	-	2	4
<b>Exp 4</b>	Vectors and Matrices, commands to operate on vectors and matrices, matrix manipulations.		-	-	2	-	2	-	2	4
<b>Exp 5</b>	Solving three linear equations		-	-	2	-	2	-	2	4
<b>Exp 6</b>	Matrix Theory – Basic Operations using Matrix		-	-	2	-	2	-	2	4
<b>Exp 7</b>	Solving a system of equations using Matrix inv function		-	-	2	-	2	-	2	4
<b>Exp 8</b>	Finding Eigen values and Eigen vectors of a ( $2 \times 2$ , $3 \times 3$ and $4 \times 4$ )		-	-	2	-	2	-	2	4
<b>Exp 9</b>	Solving a system of $3 \times 3$ matrix using Gauss Elimination method		-	-	3	-	2	-	2	4
<b>Exp 10</b>	Solving a system of $3 \times 3$ matrix using Gauss Jordan method		-	-	3	-	2	-	2	4
	<b>TOTAL</b>		10	15	22	8	55	-	36	91

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	<b>THEORY</b>				
	Poster presentation (CLO 2)	2%	1	3	4
	Paper presentation (CLO 2)	2%	1	3	4
	Project report (CLO 4)	2%	-	3	3
	Digital report (CLO 4)	2%	-	3	3
	Assignment (500 words) (CLO 4)	2%	-	3	3
	CIA 1	5%	2	6	8



	CIA 2	5%	2	6	8
	CIA 3	5%	3	9	12
	<b>Total (Theory-Continuous/Internal)</b>	<b>25%</b>	<b>9</b>	<b>36</b>	<b>45</b>
	Practical Tests (CLO 5)	5%	1	3	4
	Computer Simulation (CLO 5)	5%	1	3	4
	Record (CLO5)	5%	-	3	3
	CIA 1 (P3)	5%	2	6	8
	CIA 2(P3)	5%	2	6	8
	<b>Total (Practical-Continuous/Internal)</b>	<b>25%</b>	<b>6</b>	<b>21</b>	<b>27</b>
<b>14</b>	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - SLT (12+13+14)</b>					<b>175</b>
<b>15</b>	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	Software			
<b>16</b>	<b>References</b>	1. Amos Gilat. (2013). <i>MATLAB - An Introduction with applications</i> . Wiley India Pvt. Ltd.			
<b>17</b>	<b>Additional References</b>	. 1. Laurene V Fausett. (2012). <i>Applied Numerical Analysis Using MATLAB</i> , Dorling Kindersley Pvt. Ltd.  2. Rudra Pratap. (2003). <i>Getting Sartetd with MATLAB – A Auick Introduction for Scientists and Engineers</i> . Oxford University Press.			
<b>18</b>	<b>Theory and Problems</b>	Theory : 50% Problems : 50%			
<b>19</b>	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023			
<b>20</b>	<b>Approved Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>			

Course Coordinator- Dr. Buvaneswari. R

**Board Chairman**  
(Seal and Signature with date)

1	Name of the Course	Real Analysis	
2	Course Code	22MAU18	
3	Course Type	Theory	Focus On –Skill Development
4	Synopsis/Rationale of the Module	This course provides students with a basic understanding in Real Number System, Set Theory, Point Set Topology, Continuous and Derivatives.	
5	Semester and Year Offered	V Sem; Year III	
6	Credit Value	4	
7	Pre-requisite (if any)	Knowledge in H.Sc	
8	Assessment Strategy	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Build the Properties of Bounded sets and Countable Sets.	C4 (Analyse)	Lecture/Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO2</b>	Explain the Properties of Point Set Topology as a Poster Presentation.	A3 (Valuing)	Tutorial/Problem based Learning	1. Poster Presentation 2. Project 3. Digital Report
	<b>CLO 3</b>	Evaluate the Concepts of limit and continuity	C5 (Evaluate)	Lecture/Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Explain the Properties of Differentiation as a Case study Assignment.	A4 Organizing (Value)	Case Study/ Project	4. Assignment 5. Journal Writing

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>		✓									
	<b>CLO2</b>						✓					
	<b>CLO 3</b>							✓				
	<b>CLO 4</b>									✓		

11	<b>Transferable skills</b>	1	Critical Thinking
		2	Digital Skills
		3	Numeracy Skill
		4	Life Long Learning

12	Distribution of Student Learning Time-( <b>*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,</b> )** F2F-Face to Face; NF2F-Non Face to Face										
	Course Content outline	CLO	Teaching-Learning Activities								SLT
			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)		
			L	T	P	O	Total				

<b>Unit I</b>	<b>Real number system &amp; Set theory:</b> <ul style="list-style-type: none"> <li>Integers, Rationals, Irrationals, Intervals &amp; Functions</li> <li>The field and order axioms</li> <li>The unique Factorization theorem</li> <li>Least upper bound-The completeness axioms</li> <li>The Archimedean Property- The Cauchy-Schwarz inequality.</li> <li>Countable and uncountable sets</li> <li>Uncountability of the real number system</li> </ul>	CLO 1	9	3	-	-	12	-	9	<b>21</b>
<b>Unit II</b>	<b>Elements of point set topology:</b> <ul style="list-style-type: none"> <li>Euclidean space <math>R^n</math>, Open balls &amp; open sets in <math>R^n</math> &amp; <math>R^1</math></li> <li>Closed sets, Adherent and Accumulation points</li> <li>The Bolzano-Weierstrass theorem and The Cantor intersection theorem</li> <li>Lindel of covering theorem &amp; The Heine-Borel covering theorem</li> <li>Compactness in <math>R^n</math>-Metric Spaces</li> </ul>	CLO 1	8	3	-	-	11	-	9	<b>21</b>
	Explain the Properties of Point Set Topology as a Poster Presentation.	CLO 2	-	-	-	4	4	-	-	<b>4</b>
<b>Unit</b>	<b>Limits &amp; Continuity:</b>	CLO	9	3	-	-	12	-	10	<b>22</b>

<b>III</b>	<ul style="list-style-type: none"> <li>Convergent &amp; Cauchy Sequences-Complete metric Spaces</li> <li>Limit of a function-Continuous functions</li> <li>Continuity of Composite functions</li> <li>Continuity and inverse images of open or closed sets</li> <li>Functions continuous on compact sets</li> </ul>	3								
<b>Unit IV</b>	<b>Limits &amp; Continuity:</b> <ul style="list-style-type: none"> <li>Topological mappings</li> <li>Bolzano's theorem</li> <li>Connectedness-Components of metric space</li> <li>Uniform continuity and compact sets</li> <li>Fixed point theorem for contractions</li> </ul>	CLO 3	9	3	-	-	12	-	10	<b>22</b>
<b>Unit V</b>	<b>Derivatives:</b> <ul style="list-style-type: none"> <li>Definition of Derivative - Derivative and continuity</li> <li>Algebra of derivatives &amp; The chain rule</li> <li>One sided, infinite, non-zero &amp; zero derivatives and local extreme</li> <li>Roll's theorem</li> <li>The mean value theorem for derivatives</li> </ul>	CLO 3	9	3	-	-	12	-	10	<b>22</b>
	Explain the Properties of Differentiation as a Case study Assignment.	CLO 4	-	-	-	3	3	-	-	<b>3</b>
	<b>Total</b>		<b>44</b>	<b>15</b>	<b>-</b>	<b>7</b>	<b>66</b>	<b>-</b>	<b>48</b>	<b>114</b>

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Poster Presentation (CLO2)	5%	1	3	4
	Project(CLO2)	5%	-	3	3
	Digital Report (CLO2)	5%	-	3	3
	Assignment (500 words) (CL04)	5%	-	3	3
	Journal Writing (CL04)	5%	-	6	6
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	Total (Continuous Assessment/Internal)	50%	8	39	47
14	Final Exam/Summative Assessment/End Semester Exam	50%	3	9	12
Grand Total - TSLT (10+11+12)					173
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1. Apostol, Tom M. (2002). <i>Mathematical Analysis</i> . Addison-Wesley Publishing Company Inc.			
		Unit	Chapter	Section	Page
		I	1 & 2	1.2,1.3,1.7,1.10,1.11, 1.14,1.19, 2.12 & 2.13	2,3,5,6,8,9,11, 14,39 &40
		II	3	3.2 to 3.13	47 to 61
		III	4	4.2 to 4.5, 4.8,4.9,4.12 &4.13	70 to 76,78 to 80 & 81 to 84
		IV	4	4.14 to 4.17 & 4.19 to 4.21	84 to 87 & 90 to 92
		V	5	5.2 to 5.10	104 to 111
17	Additional References	1. Bartle, R.G. (2009). <i>Elements of Real Analysis</i> .John Wily and Sons. 2. Roydon, H.L. (2013). <i>Real Analysis</i> . Macmillan. 3. Rudin, W. (2016). <i>Principles of Mathematical Analysis</i> . McGraw Hill Company.			
18	Theory and Problems	Theory : 80% Problems : 20%			
19	Recommended by BOS	Date : 06.05.2023			

20	Approved by Academic Council	Resolution No. Date:
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**Course Co-ordinator : Mr. Madhan V**

**Board Chairman  
(Seal and Signature with date)**

1	Name of the Course	Special Functions	
2	Course Code	22MAU19	
3	Course Type	Theory	Focus On – Skill Development
4	Synopsis/Rationale of the Module	This course provides students with a basic understanding computational skill in certain special functions which are frequently occurring in higher mathematics and mathematical physics. It enables students to solve and derive recurrence formula for Bessel's functions, Legendre polynomials.	
5	Semester and Year Offered	V Sem; Year III	
6	Credit Value	4	
7	Pre-requisite (if any)	Knowledge in basic mathematics	
8	Assessment Strategy	50% External, and 50% Internal	

9	<b>Course Learning Outcomes(write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO1</b>	<b>Apply</b> the concept of Beta and gamma Functions. Also to find Frobenius series solution for some special equations	C4 (Analyze)	Lecture/Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO2</b>	<b>Practice</b> series solutions of beta and gamma function and some integral problems as a simulation exercise and group assignments	A2 (Responding to Phenomena)	Case Study / Group Discussion	1. Simulation Exercise 2. Group Assignments
	<b>CLO3</b>	<b>Evaluate</b> some properties of series solutions of Bessel's functions and series solution of Legendre's equation	C5 (Evaluate)	Lecture/Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO4</b>	<b>Explain</b> about Legendre Equation and Legendre polynomial as a project report	A3 (Valuing)	Case study Assignments/ Group Discussion	3. Assignment 4. Reports 5. Project Report

10	<b>Mapping CLO's with PLO's(select the learning domain for each CLO's and map it with PLO's; For example, CLO1-Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO1</b>											
	<b>CLO2</b>											
	<b>CLO3</b>											
	<b>CLO4</b>											

11	Transferable Skills	1	Critical Thinking
		2	Numeracy Skill
		3	Teamwork Skill
		4	Lifelong Learning

12	Distribution of Student Learning Time-( <b>*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical(Lab &amp; Demonstration); O-Others i.e., case study, Problem based learning, Group discussion learning etc.,</b> ) <b>**F2F-Face to Face;NF2F–Non-Face to Face</b>									
	Course Content outline	CLO	Teaching-Learning Activities							SLT
			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
L	T	P	O	Total						
Unit I	<b>Beta and Gamma Functions</b> • Improper Integrals- definition, Gamma Function, Recurrence Formula for $\Gamma(n)$ • Connection between Gamma function and Factorials • Value of $\Gamma(1/2)$ • Beta Functions, Other forms of the Beta Functions • Relation Between Gamma and Beta functions • Applications of Gamma and Beta Functions • Problems	CLO 1	9	3	-	-	12	-	9	21



<b>Unit II</b>	<b>Solution of Differential Equations</b> <ul style="list-style-type: none"> <li>• Introduction – Series Solution.</li> <li>• Method of Frobenius- Roots of the indicial equation unequal and differing by a fraction</li> <li>• Problems</li> <li>• Frobenius Series Solution</li> <li>• Roots of the indicial equation</li> <li>• Equal (up to Example 6)</li> </ul>	CLO 1	8	3	-	-	11	-	9	<b>21</b>
	<b>Practice</b> series solutions of beta and gamma function and some integral problems as a simulation exercise and group assignments	CLO 2	-	-	-	4	4	-	-	<b>4</b>
<b>Unit III</b>	<b>Solution of Bessel's Equation</b> <ul style="list-style-type: none"> <li>• Solution of Bessel Equation of order zero</li> <li>• Expansions of <math>J_0(x)</math> and <math>J_1(x)</math></li> <li>• The zeros of the Bessel functions</li> </ul>	CLO 3	9	3	-	-	12	-	10	<b>22</b>
<b>Unit IV</b>	<b>Properties</b> <ul style="list-style-type: none"> <li>• Values of <math>J_{1/2}(x)</math> and <math>J_{-1/2}(x)</math></li> <li>• Recurrence formula for Bessel Functions</li> <li>• Bessel coefficients</li> <li>• Some important integral</li> <li>• Problems</li> </ul>	CLO 3	9	3	-	-	12	-	10	<b>22</b>

<b>Unit V</b>	<b>Legendre Equations and Legendre Polynomials</b> <ul style="list-style-type: none"> <li>Series Solution of Legendre's equation</li> <li>Trigonometric form of Legendre's Equations</li> <li>Legendre Polynomial</li> <li>Problems</li> <li>Rodrique's formula for Legendre Polynomials</li> </ul>	CLO 3	9	3	-	-	12	-	10	<b>22</b>
	<b>Explain</b> about Legendre Equation and Legendre polynomial as a project report	CLO 4	-	-	-	3	3	-	-	<b>3</b>
	<b>Total</b>		<b>44</b>	<b>15</b>	<b>-</b>	<b>7</b>	<b>66</b>	<b>-</b>	<b>48</b>	<b>114</b>

<b>13</b>	<b>Continuous Assessment</b>	<b>Percentage(%)</b>	<b>F2F(hours)</b>	<b>NF2F(hours)</b>	<b>SLT</b>
	Simulation Exercise(CLO2)	5%	-	3	3
	Group Assignment(CLO2)	5%	-	3	3
	Assignment (500 words) (CLO5)	5%	-	3	3
	Reports (CLO5)	5%	-	3	3
	Project work(CL05)	5%	2	6	8
	CIA1	7.5%	2	6	8
	CIA2	7.5%	2	6	8
	CIA3	10%	3	9	12
	<b>Total(Continuous Assessment/Internal)</b>	<b>50%</b>	<b>9</b>	<b>36</b>	<b>45</b>
<b>14</b>	<b>Final Exam/Summative Assessment/ End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -TSLT(12+13+14)</b>					<b>171</b>
<b>15</b>	<b>Identify special requirements to deliver the course (Software, Simulation room,computer labetc.,)</b>	NIL			
<b>16</b>	<b>References</b>	1. Venkataraman, M.K. (2001). <i>Higher Mathematics for Engineering and Science</i> . National Publishing Company. Unit-I ; Chapter I : Sec 1 to 11 ; Pg.No 1 to 27 Unit-II : Chapter II: Sec 1 to 2;Pg No 29 to 47 Unit -III: Chapter III: Sec 1 to 4; Pg No: 58 to 66 Unit-IV : Chapter III: Sec 5 to 8 ; Pg No :66 to 79 Unit -V :Chapter IV : Sec 1 to 5 ; Pg No 114 to 122 and 125 to 130 [except exercise problem 5]			

17	<b>Additional References</b>	1. NitaH.Shah. (2001), <i>Ordinary and Partial Differential Equations: Theory and Applications</i> . PHI Learning Private Limited.
18	<b>Theory and Problems</b>	Theory : 20% Problems : 80%
19	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023
20	<b>Approved by Academic Council</b>	<b>Resolution No</b> <b>Date:</b>

**Course Coordinator: Ms. Narmatha S**

**Board Chairman**  
**(Seal and Signature with date)**

1	<b>Name of the Course</b>	<b>Number Theory</b>	
2	<b>Course Code</b>	22MAU20 - Theory	
3	<b>Course Type</b>	Theory	Focus On – <b>Skill Development</b>
4	<b>Synopsis/Rationale of the Module</b>	This course provides a helpful tool to understand the number theory, which has contributed significantly to the development of Algebra and Analysis.	
5	<b>Semester and Year Offered</b>	V Sem; Year III	
6	<b>Credit Value</b>	4	
7	<b>Pre-requisite (if any)</b>	Knowledge about divisibility rules and congruences	
8	<b>Assessment Strategy</b>	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Apply division algorithm and Euclidean Algorithm in various applications	C3 (Apply)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Explain congruences and quadratic reciprocity as a group assignment	A4 (Organizing Value)	Tutorial/ Research based learning	1.Group Assignment 2.Group Reports
	<b>CLO 3</b>	Examine greatest integer function and some Diophantine equations	C4 (Analyse)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Relate some Diophantine equations with real life applications as a case study assignment	A4 (Organizing Value)	Tutorial/ Research based learning	3. Assignment 4. Case Study Assignment 5.Designing Project

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>		√									
	<b>CLO 2</b>				√							
	<b>CLO 3</b>							√				
	<b>CLO 4</b>										√	

11	<b>Transferable skills</b>	1	Critical Thinking
		2	Teamwork Skill
		3	Numeracy Skill
		4	Entrepreneurial Skill

12	Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face									
	Course Content outline	CLO	Teaching-Learning Activities							SLT
			Guided Learning (F2F)					E- Lear ning	Independent Learning (NF2F)	
			L	T	P	O	Total			
Unit I	<b>Divisibility</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Divisibility</li><li>• Division Algorithm</li><li>• Euclidean Algorithm</li><li>• Primes</li></ul>	CLO1	9	2	-	-	11	-	11	22
Unit II	<b>Congruences</b> <ul style="list-style-type: none"><li>• Congruences</li><li>• Solution of Congruences</li><li>• The Chinese Remainder theorem</li><li>• Prime power moduli</li><li>• Prime modules</li></ul>	CLO1	8	2	-	-	10	-	10	20
Unit III	<b>Quadratic Reciprocity and Quadratic Forms</b> <ul style="list-style-type: none"><li>• Quadratic residue</li><li>• Quadratic Reciprocity</li><li>• The Jacobi Symbol</li><li>• Binary Quadratic Forms</li></ul>	CLO1	8	2	-	-	10	-	10	20
	Explain congruences and quadratic reciprocity as a group assignment	CLO2	-	-	-	2	2	-	-	2
Unit IV	<b>Some Functions of Number Theory</b> <ul style="list-style-type: none"><li>• Greatest Integer Functions</li><li>• Arithmetic Functions</li><li>• The Mobius Inversion Formula</li><li>• Recurrence Functions</li></ul>	CLO3	8	2	-	-	10	-	10	20
Unit V	<b>Some Diophantine Equations</b> <ul style="list-style-type: none"><li>• The equation <math>ax + by = c</math></li><li>• Simultaneous Linear Equations</li><li>• Pythagorean Triangles</li><li>• Assorted Examples</li></ul>	CLO3	8	2	-	-	10		10	20
	Relate some Diophantine equations with real life applications as a case study assignment	CLO4	-	-	-	2	2	-	-	2
	<b>Total</b>		<b>41</b>	<b>10</b>	<b>-</b>	<b>4</b>	<b>55</b>	<b>-</b>	<b>51</b>	<b>106</b>

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Group Assignment ( CLO 2)	5%	-	3	3
	Group Report (CLO 2)	5%	-	3	3
	Assignment (CLO 3)	5%	-	3	3
	Case Study Assignment (CLO 3)	5%	-	3	3
	Designing Project (CLO 4)	5%	-	3	3
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>7</b>	<b>36</b>	<b>43</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -TSLT (12+13+14)</b>					<b>161</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1. Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery. (2013). <i>An introduction to the theory of Numbers</i> . Wiley. Fifth Edition.			
17	Additional References	1. Apostol, T.M. (1976). <i>Introduction to Analytic Number Theory</i> . Springer Verlag. 2. Kennath, Rosan. (1968). <i>Elementary number theory and its applications</i> Addison Wesley Publishing Company.			
18	Theory and Problems	Theory : 50% Problems : 50%			
19	Recommended by BOS	Date : 06.05.2023			
20	Approved Academic Council	Resolution No Date:			

Course Coordinator: Dr. Buvaneswari. R

**Board Chairman**  
(Seal and Signature with date)

1	<b>Name of the Course</b>	<b>Essential Mathematics for Machine Learning</b>	
2	<b>Course Code</b>	<b>22MAU21</b>	
3	<b>Course Type</b>	Theory	Focus On – <b>Employability</b>
4	<b>Synopsis/Rationale of the Module</b>	To familiarize students with the basic concepts, models and techniques for effective decision making, model formulation and applications.	
5	<b>Semester and Year Offered</b>	V Sem; Year III	
6	<b>Credit Value</b>	4	
7	<b>Pre-requisite (if any)</b>	Knowledge in Essential Mathematics for Machine Learning Concepts	
8	<b>Assessment Strategy</b>	50% External and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Deduce the basic concepts Vectors in Machine Learning and application of Machine Learning in various fields.	C5 (Evaluate)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Relate real life applications of NumPy as a digital report.	A4 (Organising values)	Case Study/ Group Work	1. Assignment 2. Digital Report
	<b>CLO 3</b>	Create matrix operations in Machine Learning models of conflicting situations.	C6 (Create)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Interpret techniques constructively to make effective decisions using Python as journal writing.	A5 (Internalising values)	Case Study/ Project/ Group Work	3.Journal Writing 4.Project Report 5.Report

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>							√				
	<b>CLO 2</b>						√					
	<b>CLO 3</b>							√				
	<b>CLO 4</b>									√		
11	<b>Transferable skills</b>			1	Numeracy skills							
				2	Digital Skills							
				3	Life Long Learning							

12		<b>Distribution of Student Learning Time-(<sup>*</sup>SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,)** F2F-Face to Face; NF2F-Non Face to Face</b>
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	Course Content outline	CLO	Teaching-Learning Activities							SLT
			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
			L	T	P	O	Total			
Unit I	<b>Foundations</b> <ul style="list-style-type: none"><li>• Introduction to Linear Algebra</li><li>• Linear Algebra and Machine Learning</li><li>• Examples of Linear Algebra in Machine Learning</li></ul>	CLO 1	6	4	-	-	10	-	12	22
Unit II	<b>NumPy</b>  Introduction to NumPy Arrays  Index, Slice and Reshape NumPy Arrays  NumPy Array Broadcasting	CLO 1	6	4	-	-	10	-	11	21
	Relate real life applications of NumPy as a digital report.		-	-	-	4	4	-	-	4
Unit III	<b>Matrices</b> <ul style="list-style-type: none"><li>• Vectors and Vector Arithmetic</li><li>• Vector Norms</li></ul>	CLO 2	7	3	-	-	10	-	11	21
Unit IV	<b>Matrices</b> <ul style="list-style-type: none"><li>• Matrices and Matrix Arithmetic</li><li>• Types of Matrices</li><li>• Matrix Operations</li></ul>	CLO 2	6	2	-	-	8	-	5	13
Unit V	<b>Matrices</b> <ul style="list-style-type: none"><li>• Sparse Matrices</li><li>• Tensors and Tensor Artihmetic</li></ul>	CLO 3	7	2	-	-	9	-	11	20
	Interpret techniques constructively to make effective decisions using	CLO4	-	-	-	4	4	-	-	4



<b>13</b>	<b>Continuous Assessment</b>	<b>Percentage (%)</b>	<b>F2F (hours)</b>	<b>NF2F (hours)</b>	<b>SLT</b>
	Assignment (CLO2)	5%	-	3	3
	Digital Report (CLO2)	5%	-	3	3
	Journal Writing (CLO4)	5%	-	3	3
	Project Report (CLO4)	5%	-	3	3
	Report (CLO4)	5%	-	3	3
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>07</b>	<b>36</b>	<b>43</b>
<b>14</b>	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -TSLT (12+13+14)</b>					<b>160</b>
<b>15</b>	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	NIL			
<b>16</b>	<b>References</b>	1. Jason Brownlee. (2018). <i>Basics of Linear Algebra for Machine Learning</i> . Unit I Chapter 2 Section 1.1-1.7 Page No.1-15 Section 2.1-2.8 Section 3.1-3.12 Unit II Chapter 3 Section 4.1-4.7 Page No.17-42 Section 5.1-5.8 Section 6.1-6.8 Unit III Chapter 4 Section 7.1-7.9 Page No.43-57 Section 8.1-8.8 . Unit IV Chapter 4 Section 9.1-9.10 Page No.58-88 Section 10.1-10.10 Section 11.1-11.9 Unit V Chapter 4 Section 12.1-12.9 Page No.90-107 Section 13.1-13.8			
<b>17</b>	<b>Additional References</b>	1. NumPy Reference. <a href="https://docs.scipy.org/doc/numpy-1.13.0/reference/">https://docs.scipy.org/doc/numpy-1.13.0/reference/</a>			
<b>18</b>	<b>Theory and Problems</b>	Theory : 100% Problems : -			
<b>19</b>	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023			
<b>20</b>	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>			

**Course Coordinator: Dr. Buvaneswari. R**

**Board Chairman  
(Seal and Signature with date)**

1	<b>Name of the Course</b>	<b>Introduction to Industry 4.0</b>	
2	<b>Course Code</b>	<b>22MAU22</b>	
3	<b>Course Type</b>	Theory	Focus On – <b>Employability</b>
4	<b>Synopsis/Rationale of the Module</b>	This course provides a helpful tool to impart knowledge on digital transformations	
5	<b>Semester and Year Offered</b>	V Sem; Year III	
6	<b>Credit Value</b>	4	
7	<b>Pre-requisite (if any)</b>	Knowledge about Big Data, IoT and Artificial Intelligence	
8	<b>Assessment Strategy</b>	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Determine big data, artificial intelligence and cyber security.	C4 (Analyse)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Explain application of Artificial Intelligence as assignment and prepare future prospects of AI as digital reports.	A4 (Organizing Values)	Tutorial/Group Discussion	1..Assignment 2.Digital Reports 3.Project Report
	<b>CLO3</b>	Evaluate societal influences of AI and big data applications. Classify Industry 4., Education 4.0, Curriculum 4.0, Faculty 4.0 and intelligence jobs in 2030.	C5 (Evaluate)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Interpret Industry 4., Education 4.0, Curriculum 4.0, Faculty 4.0 and intelligence jobs in 2030 by leading a team	A5 (Internalising Values)	Tutorial/Group Discussion	4.Case Study Assignment 5.WSQ

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>		√									
	<b>CLO 2</b>						√					
	<b>CLO 3</b>		√									
	<b>CLO 4</b>								√			

11	<b>Transferable skills</b>	1	Critical Thinking
		2	Digital Skill
		3	Leadership Skill

12	Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face									SLT
	Course Content outline	CLO	Teaching-Learning Activities							
			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
			L	T	P	O	Total			
Unit I	<b>Industry 4.0</b> <ul style="list-style-type: none"><li>• Need</li><li>• Reason for Adopting Industry 4.0</li><li>• Definition</li><li>• Goals and Design Principles</li><li>• Technologies of Industry 4.0</li><li>• Big Data – Artificial Intelligence (AI)</li><li>• Industrial Internet of Things</li><li>• Cyber Security</li><li>• Cloud</li><li>• Augmented Reality.</li></ul>	CLO 1	6	4	-	-	10	-	12	22
Unit II	<b>Artificial Intelligence</b> <ul style="list-style-type: none"><li>• Artificial Intelligence (AI) – What &amp; Why?</li><li>• History of AI</li><li>• Foundations of AI</li><li>• The AI -environment Societal Influences of AI</li><li>• Application Domains and Tools</li><li>• Associated Technologies of AI</li><li>• Future Prospects of AI</li><li>• Challenges of AI .</li></ul>	CLO 1	6	4	-	-	10	-	11	21
	Explain application of Artificial Intelligence as assignment and prepare future prospects of AI as digital reports.	CLO 2	-	-	-	4	4	-	-	4
Unit III	<b>Big Data</b> <ul style="list-style-type: none"><li>• Evolution</li><li>• Data Evolution</li><li>• Data : Terminologies Big Data Definitions Essential of Big Data in Industry 4.0</li><li>• Big Data Merits and Advantages</li><li>• Big Data Components : Big</li></ul>	CLO 3	7	3	-	-	10	-	11	21

	Data Characteristics • Big Data Processing Frameworks • Big Data Applications • Big Data Tools									
<b>Unit IV</b>	<b>Internet of Things (IoT)</b> • Introduction to IoT • Architecture of IoT • Technologies for IoT • Developing IoT Applications • Applications of IoT • Security in IoT	CLO 3	6	2	-	-	8	-	5	13
<b>Unit V</b>	<b>Jobs 2030</b> • Industry 4.0 • Education 4.0 • Curriculum 4.0 • Faculty 4.0 • Skills required for Future • Tools for Education Artificial Intelligence Jobs in 2030 • Jobs 2030 • Framework for aligning Education with Industry 4.0 .	CLO 3	7	2	-	-	9	-	11	20
	Interpret Industry 4., Education 4.0, Curriculum 4.0, Faculty 4.0 and intelligence jobs in 2030 by leading a team	CLO 4	-	-	-	4	4	-	-	4
<b>TOTAL</b>			<b>32</b>	<b>15</b>	<b>-</b>	<b>8</b>	<b>55</b>	<b>-</b>	<b>50</b>	<b>105</b>

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Assignment (500 words) (CLO2)	5%	-	3	3
	Digital Report (CLO 2)	5%	-	3	3
	Project Report (CLO 2)	5%	-	3	3
	Case Study Assignment (CLO 4)	5%	-	3	3
	WSQ(CLO 4)	5%	-	3	3
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>07</b>	<b>36</b>	<b>43</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -TSLT (12+13+14)</b>					<b>160</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1.Kaliraj, P. and Devi, T. (2021). <i>Higher Education for</i>			

		<i>Industry 4.0 and Transformation to Education 5.0.</i>
17	<b>Additional References</b>	2. <a href="https://nptel.ac.in/courses/106/105/106105195">https://nptel.ac.in/courses/106/105/106105195</a>
18	<b>Theory and Problems</b>	Theory : 100% Problems : -
19	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023
20	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>

Course Coordinator: Dr. Buvaneswari. R

**Board Chairman**  
**(Seal and Signature with date)**

1	Name of the Course	Practical – LaTeX	
2	Course Code	22MAU23	
3	Course Type	Practical	Focus on Skill Development
4	Synopsis/Rationale of the Module	This Practical / Laboratory course is designed to provide the students with the knowledge to prepare their own documents in different environments. In addition, the students will learn how to apply and build their confidence to work in LaTeX.	
5	Semester and Year Offered	Sem V; Year III	
6	Credit Value	3	
7	Pre-requisite (if any)	Knowledge on Basic equations and matrices	
8	Assessment Strategy	50% External and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO1</b>	Show various types of lists, question paper and time table in LaTeX.	P2 (Set)	Practical/ Demonstration	Practical Tests
	<b>CLO2</b>	Construct different types of equations using ARRAY and matrices	P3 (Guided Response)	Practical/ Demonstration	Practical Tests
	<b>CLO3</b>	Build their project work in Latex and import the pictures using LaTeX Draw.	P4 (Mechanism)	Practical/ Demonstration	Practical Tests

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Practical skills- PLO 3; CLO 2- Practical skills; PLO 3, CLO 3 - practical skills- PLO 3)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO1</b>			✓								
	<b>CLO2</b>			✓								
	<b>CLO3</b>			✓								

11	Transferable skills	1	Practical Skill
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12	Distribution of Student Learning Time-( <b>*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,)** F2F-Face to Face; NF2F-Non Face to Face</b>									
	Course Content Outline	CLO	Teaching-Learning Activities						SLT	
			Guided Learning (F2F)					E-Lear ning		Independent Learning (NF2F)
			L	T	P	O	Total			
Exp 1	<ul style="list-style-type: none"><li>Command names and arguments-Environments-Declarations in LaTeX</li></ul>	CLO 1	-	-	2	-	2	-	1	3
Exp 2	<ul style="list-style-type: none"><li>Preparation of title page and adding footnotes inLATEX</li></ul>	CLO 1	-	-	2	-	2		1	3
Exp 3	<ul style="list-style-type: none"><li>Making ordered, unordered, nested lists using</li><li>Itemize and enumerate environment in LATEX</li></ul>	CLO 1	-	-	2	-	2		2	4
Exp 4	<ul style="list-style-type: none"><li>Preparing simple table in LATEX</li></ul>	CLO 1	-	-	2	-	2		1	3
Exp 5	<ul style="list-style-type: none"><li>Preparing tables in LATEX with multiple title rows and columns</li></ul>	CLO 1	-	-	2	-	2		2	4
Exp 6	<ul style="list-style-type: none"><li>Preparing Different types mathematical of equations with</li><li>Special Characters</li><li>ARRAY.</li></ul>	CLO 2	-	-	2	-	2		2	4
Exp 7	<ul style="list-style-type: none"><li>Typing system of equations by matrix in LATEX.</li></ul>	CLO 2	-	-	2	-	2		1	3
Exp 8	<ul style="list-style-type: none"><li>Equations using left cases and right cases in LATEX.</li></ul>	CLO 2	-	-	2	-	2		1	3
Exp 9	<ul style="list-style-type: none"><li>Prepare Binomial Distribution</li></ul>	CLO 2	-	-	2	-	2		2	4



Exp 10	• Prepare Question paper template using Latex	CLO 2	-	-	2	-	2		2	4
Exp 11	• Importing and drawing pictures in LATEX.	CLO 3	-	-	2	-	2		2	4
Exp 12	• Inserting floating elements in a multicolumn document withwrap fig and wrap table.	CLO 3			3		3		2	5
Exp 13	• Preparation of Project format with Theorem-like declarations. Boxes, Tables, footnotes and marginal notes in LATEX.	CLO 3			3		3		2	5
Exp 14	• Prepare paper publication format in Latex.	CLO 3			2		2		2	4
Exp 15	• Prepare Book environment in Latex	CLO 3			3		3		2	5
<b>Total</b>			-	-	<b>33</b>	-	<b>33</b>		<b>25</b>	<b>58</b>

13	Continuous Assessment	Percentage(%)	F2F(hours)	NF2F(hours)	SLT
	Practical Test 1	10%	1	3	4
	Practical Test 2- Poster Presentation (With relevant to the topic withexample)	5%	1	3	4
	Practical Test 3	5%	1	3	4
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total(Continuous Assessment/Internal)</b>	<b>50%</b>	<b>10</b>	<b>30</b>	<b>40</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -SLT(12+13+14)</b>					<b>110</b>
15	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	Texstudio 2.12.14version/Texstudio2.12.22version			
16	<b>References</b>	1. Kopka, H., Daly, P.W. (2000). <i>A Guideto LATEX</i> . Addison-Wesley,London.			
17	<b>Additional References</b>	1. Leslie Lamport. (1994). <i>LaTeX: A Document Preparation System</i> . Addison-Wesley.			

18	Theory and Problems	Theory : - Problems : 100%
19	Recommended byBOS	Date : 30.06.2022
20	Approved by Academic Council	Resolution No. Date:

Course Coordinator : Ms. Narmatha. S

Board Chairman  
(Seal and Signature with date)

1	Name of the Course	Practical - Computational Mathematics using SymPy	
2	Course Code	22MAU24	
3	Course Type	Practical	Focus On – Employability
4	Synopsis/Rationale of the Module	This course provides the students a strong foundation on mathematical concepts using SymPy	
5	Semester and Year Offered	V Sem ; Year III	
6	Credit Value	3	
7	Pre-requisite (if any)	Knowledge on mathematical concepts and problems.	
8	Assessment Strategy	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Explain the number symbol, and substitution using SymPy.	P2 - Set	Practical Demonstration	Practical Test
	<b>CLO 2</b>	Construct concepts on functions and logical expressions using SymPy	P3 – Guided Response	Practical Demonstration	Practical Test
	<b>CLO 3</b>	Build concepts on derivatives, integration and matrices using SymPy	P4 - Mechanism	Practical Demonstration	Practical Test

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Practical skills- PLO 3; CLO 2- Practical skills; PLO 3, CLO 3 - practical skills – PLO 3</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>											
	<b>CLO 2</b>											
	<b>CLO 3</b>											

11	<b>Transferable skills</b>	1	Practical Skill
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12	Distribution of Student Learning Time-( <b>*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,</b> ) <b>** F2F-Face to Face; NF2F-Non Face to Face</b>									
	Course Content outline	CLO	Teaching-Learning Activities						SLT	
			Guided Learning (F2F)					E-Learn ing		Independent Learning (NF2F)
			L	T	P	O	Total			
Exp 1	SymPy – Introduction, Numbers, Symbols	CLO 1	-	-	4	-	4	-	5	9
Exp 2	SymPy – Substitution	CLO 1	-	-	4	-	4		5	9
Exp 3	SymPy – Symplify() function	CLO 2	-	-	4	-	4		5	9
Exp 4	SymPy – evalf() function,	CLO 2	-	-	3	-	3		5	8
Exp 5	SymPy – Lambdify() function	CLO 2	-	-	3	-	3		5	8
Exp 6	SymPy –Logical Expressions	CLO 2	-	-	3	-	3		5	8
Exp 7	SymPy –Simplification	CLO 2	-	-	3	-	3		5	8
Exp 8	SymPy – Derivatives	CLO 3	-	-	3	-	3		4	7
Exp 9	SymPy – Integration	CLO 3	-	-	3	-	3		4	7
Exp 10	SymPy – Matrices	CLO 3	-	-	3	-	3		4	7
	Total		-	-	33	-	33	-	47	80

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Practical Test I	10%	1	3	4
	Practical Test 2-Poster Presentation (With relevant to the topic with example)	5%	1	3	4
	Practical Test 3	5%	1	3	4
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total(Continuous Assessment/Internal)</b>	<b>50%</b>	<b>10</b>	<b>30</b>	<b>40</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	50%	3	9	12

Grand Total - SLT (12+13+14)		132
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	Sympy 1.5.1.
16	References	1. Mathematical Computation with Sage by Paul Zimmenmann ( <a href="http://www.sagemath.org">http://www.sagemath.org</a> ) 2. Instant Sympy starter by Ronan Lamy
17	Additional References	1. An introduction to SAGE Programming: With Applications to SAGE Interacts for Numerical Methods by Razvan A Mezei, Springer 2. <a href="https://www.sympy.org/en/index.html">https://www.sympy.org/en/index.html</a>
18	Theory and Problems	Theory : - Problems : 100%
19	Recommended by BOS	Date: 30.06.2022
20	Approved by Academic Council	Resolution No. Date:

Course Coordinator : Dr. Buvaneswari. R

Board Chairman  
(Seal and Signature with date)

1	Name of the Course	Linear Algebra	
2	Course Code	22MAU25	
3	Course Type	Theory	Focus On – Skill Development
4	Synopsis/Rationale of the Module	This course offers students with a knowledge of Trigonometry and Fourier Series which has applications in both pure and applied mathematics.	
5	Semester and Year Offered	VI Sem; Year III	
6	Credit Value	4	
7	Pre-requisite (if any)	Basic Knowledge in Group theory and Matrix theory.	
8	Assessment Strategy	50% External and 50 % Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Analyse Vector spaces and its examples and concept of linear independent and dependent	C4 (Analyse)	Lecture/ Tutorial/Case Study/ Problem Solving	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Study the case study based problems on Vector Spaces, Justify the theorems related to vector spaces with suitable examples and complete the problems on linear independent and linear dependent as a technical presentation.	A3 (Valuing)	Case Study/ Project/ Tutorial/ Group Work/Problem based learning	1.Technical Presentation 2. Socratic Seminar 3.WSQ
	<b>CLO 3</b>	Evaluate Matrices and its characteristics by Elementary Transformations and Cayley Hamilton theorem	C5 (Evaluate)	Lecture/ Tutorial/Case Study/ Problem Solving	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Formulate the inner product spaces and problems on Orthogonality. Also solve the Bilinear forms and reduce quadratic forms into diagonal forms as an assignment..	A4 (Organizing Values)	Case Study/ Project/ Group Work/PBL	4.Project Report 5.Assignment

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>											
	<b>CLO 2</b>											
	<b>CLO 3</b>											
	<b>CLO 4</b>											
11	<b>Transferable skills</b>			1	<b>Critical Thinking</b>							

	2	Communication Skills
	3	Numeracy Skills
	4	Life Long Learning

12	Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,)** F2F-Face to Face; NF2F-Non Face to Face									
	Course Content outline	CLO	Teaching-Learning Activities							SLT
			Guided Learning (F2F)					E-Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O	Total			
Unit I	<b>Matrices</b> <ul style="list-style-type: none"><li>• Introduction, Types of Matrices and Inverse of a Matrix</li><li>• Elementary transformations</li><li>• Rank of Matrix</li><li>• Simultaneous linear equations</li><li>• Characteristic Equation and Cayley Hamilton theorem</li><li>• Eigen values and Eigen Vectors</li></ul>	CLO1	8	2	-	-	10	-	10	20
Unit II	<b>Basis and Dimension</b> <ul style="list-style-type: none"><li>• Theorems on Basis and Dimension</li><li>• Rank and Nullity, problems</li><li>• Matrix of a linear transformations</li><li>• Problems on Matrix of a linear transformation</li></ul>	CLO1	8	2	-	-	10	-	10	20
Unit III	<b>Vector Spaces</b> <ul style="list-style-type: none"><li>• Definition and Examples</li><li>• Subspaces</li><li>• Linear Transformations</li></ul>	CLO1	8	2	-	-	10	-	10	20

	<ul style="list-style-type: none"> <li>Span of a set, Linear Independent and Dependent</li> <li>Problems on Linear Independent and Dependent</li> </ul>									
	Study and understand the concepts of Vector Space, subspace of a vector space, Basis and dimension of vector spaces, Linear Transformation and Matrix representation of Linear Transformation then complete as a technical presentation.	CLO2				6	6			6
<b>Unit IV</b>	<b>Inner Product Space</b> <ul style="list-style-type: none"> <li>Definitions and Examples</li> <li>Schwartz's Inequality</li> <li>Orthogonality: Gram Schmidt orthogonalization process</li> <li>Problems on Gram Schmidt process</li> <li>Orthogonal Complement</li> </ul>	CLO3	10	3	-	-	13	-	7	20
<b>Unit V</b>	<b>Bilinear Forms:</b> <ul style="list-style-type: none"> <li>Definition and Examples</li> <li>Matrix of Bilinear transformations</li> <li>Quadratic forms</li> <li>Reduction of Quadratic form to diagonal form</li> </ul>	CLO3	10	3	-	-	13	-	7	20
	Explain the concepts of Inner Product space and Bilinear forms by using presentation also by an Assignment	CLO4				4	4			4
	<b>TOTAL</b>		<b>44</b>	<b>12</b>	<b>-</b>	<b>10</b>	<b>66</b>		<b>44</b>	<b>110</b>



13	<b>Continuous Assessment</b>	<b>Percentage (%)</b>	<b>F2F (hours)</b>	<b>NF2F (hours)</b>	<b>SLT</b>
	Technical Presentation (CLO 2)	5%	1	3	4
	Socratic Seminar (CLO 2)	5%	1	3	4
	WSQ (CLO 2)	5%	-	3	3
	Project Report (CLO 4)	5%	-	3	3
	Assignment (1000 words) (CLO 4)	5%	-	6	6
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment / Internal)</b>	<b>50%</b>	<b>9</b>	<b>39</b>	<b>48</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - TSLT (12+13+14)</b>					<b>170</b>
15	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	NIL			
16	<b>References</b>	1. Arumugam, S., Thangapandilssac, A. (2015). <i>Modern Algebra</i> . Scitech publications (India) Pvt. Ltd., Unit –I Chapter 7 sec: 7.2 - 7.8 Page.No: 7.6 – 7.40 Unit –II Chapter 5 sec: 5.1-5.5 Page.No: 5.1 – 5.19 Unit –III Chapter 5 sec: 5.6-5.8 Page.No: 5.19 – 5.30 Unit –IV Chapter 6 sec: 6.1- 6.3 Page.No: 6.1 – 6.9 Unit –V Chapter 8 sec: 8.1-8.2 Page.No: 8.1 – 8.7			
17	<b>Additional References</b>	1. Stephen H. Fredberg, Arnold J.Insel, Lawrence E. Spence (2003). <i>Linear Algebra</i> . Pearson Education.			
18	<b>Theory and Problems</b>	Theory : 20% Problems : 80%			
19	<b>Recommended by BOS</b>	<b>Date : 06.05.2023</b>			
20	<b>Approved by Academic Council</b>	<b>Resolution No.:</b> <b>Date:</b>			

Course Coordinator- Dr. Kungumaraj E

**Board Chairman**  
(Seal and Signature with date)

1	Name of the Course	Complex Analysis	
2	Course Code	22MAU26	
3	Course Type	Theory	Focus On –Skill Development
4	Synopsis/Rationale of the Module	This course provides students with a basic understanding in complex functions and complex integrations. It enables students to learn the connection between the complex numbers and vector calculus.	
5	Semester and Year Offered	VI Sem; Year III	
6	Credit Value	4	
7	Pre-requisite (if any)	Basic knowledge in multivariable calculus	
8	Assessment Strategy	50% External, and 50% Internal	

**9 Course Learning Outcomes (write the statement of the course learning outcomes)**

At the end of the course the students will be able to:

CLO	Statements	Level of Taxonomy	Teaching Method	Mode of Assessments
CLO 1	Discover the concepts of analytic functions, elementary complex functions and their properties	C3 Apply	Lecture/Tutorial	CIA & FINAL EXAM
CLO 2	Explain the concepts of convergence sequence and series of complex functions as a report	A3 Valuing	Case study Assignments	1. Assignment 2. Report 3. Project Report
CLO 3	Classify the nature of singularities, poles and residues and application of Cauchy Residue theorem.	C5 Evaluate	Lecture/Tutorial	CIA & FINAL EXAM
CLO 4	Relate residues with examples and real life applications as KWL.	A4(Organizing values)	Case study Assignments	4. Journal Writing 5. KWL

**10 Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)**

CLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CLO 1											
CLO 2											
CLO 3											
CLO 4											

**11 Transferable skills**

- |   |                   |
|---|-------------------|
| 1 | Critical Thinking |
| 2 | Numeracy          |
| 3 | Lifelong learning |

12	Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face									
	Course Content outline	CLO	Teaching-Learning Activities						SLT	
			Guided Learning (F2F)					E-Learning		
			L	T	P	O	Total		Independent Learning (NF2F)	
Unit I	<b>Complex Numbers:</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Complex functions and Limits of functions</li> <li>Continuous functions</li> <li>Differentiability, Cauchy-Riemann equations</li> <li>Analytic functions</li> <li>Harmonic functions; Milne Thompson Method</li> <li>Conformal mapping</li> </ul>	CLO 1	6	4	-	-	10	-	12	22
Unit II	<b>Bilinear Transformation:</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Elementary transformations</li> <li>Bilinear Transformations</li> <li>Cross ratio, Problems</li> <li>Fixed points of bilinear transformations</li> <li>Problems</li> </ul>	CLO 1	6	4	-	-	10	-	11	21
Unit III	<b>Complex Integration:</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Definite integral</li> <li>Cauchy's theorem</li> <li>Cauchy's integral formula</li> <li>Higher derivatives</li> <li>Problems</li> </ul>	CLO 1	7	3	-	-	10	-	11	21
	Explain the concepts of convergence sequence and series of complex functions as a report	CLO 2	-	-	-	4	4	-	-	4
Unit IV	<b>Series and Expansions:</b> <ul style="list-style-type: none"> <li>Introduction</li> </ul>	CLO 3	6	2	-	-	8	-	5	13

	<ul style="list-style-type: none"> <li>Taylor's series</li> <li>Laurent's series</li> <li>Zeros of an analytic function</li> <li>Singularities</li> <li>Problems</li> </ul>									
<b>Unit V</b>	<b>Residues:</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Residues</li> <li>Cauchy's residue theorem</li> <li>Argument theorem</li> <li>Rouche's theorem</li> <li>Fundamental theorem of Algebra</li> <li>Evaluation of definite integrals</li> </ul>	CLO 3	7	2	-	-	9	-	11	20
	Relate residues with examples and real life applications as portfolio.	CLO 4	-	-	-	4	4	-	-	4
	<b>Total</b>		<b>32</b>	<b>15</b>	<b>-</b>	<b>8</b>	<b>55</b>	<b>-</b>	<b>50</b>	<b>105</b>

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Assignment (CLO 2)	5%	-	3	3
	Report (CLO2)	5%	-	3	3
	Project Report (CLO2)	5%	-	3	3
	Journal Writing (CLO4)	5%	-	3	3
	KWL (CLO4)	5%	-	6	6
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total(Continuous Assessment/Internal)</b>	<b>50%</b>	<b>7</b>	<b>39</b>	<b>46</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - TSLT (12+13+14)</b>					<b>163</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1. Arumugam, S. A. Thangapandilssac, Somasundaram, A. (2014). <i>Complex Analysis</i> , Scitech Publications (India) Pvt .Ltd. Unit I Chapter 2 Sec 2.0-2.9 Pg. No. 24-67 Unit II Chapter 3 Sec 3.0-3.4 Pg. No. 74-90			

		Unit III Chapter 6 Sec 6.0-6.4 Pg.No. 132-163 Unit IV Chapter 7 Sec 7.0-7.4 Pg.No. 173-200 Unit V Chapter 8 Sec 8.0-8.3 Pg.No. 209-257
17	<b>Additional References</b>	1. Duraipandian, P. Laxmi Duraipandian, Muhilan, D. (20021). <i>Complex Analysis</i> , Emerald Publishers,
18	<b>Theory and Problems</b>	Theory : 40% Problems : 60%
19	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023
20	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>

**Course Coordinator: Ms. Nithya. S**

**Board Chairman**  
**(Seal and Signature with date)**

1	<b>Name of the Course</b>	<b>Graph Theory</b>
2	<b>Course Code</b>	<b>22MAU27</b>
3	<b>Course Type</b>	Theory   Focus On – <b>Skill Development</b>
4	<b>Synopsis/Rationale of the Module</b>	This course provides a helpful tool to quantify and simplify the many moving parts of dynamic systems.
5	<b>Semester and Year Offered</b>	VI Sem; Year III
6	<b>Credit Value</b>	4
7	<b>Pre-requisite (if any)</b>	Knowledge In basic relations
8	<b>Assessment Strategy</b>	50% External and 50% Internal

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Analyse definitions of graph theory to identify and construct examples from relations	C4 (Analyse)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Study graph theory concepts as a digital report.	A3 (Valuing)	Case Study/ Problem based learning	1.KWL 2.Digital Report
	<b>CLO 3</b>	Interpret colourability and directed graphs with real life applications.	C5 (Evaluate)	Lecture/ Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Integrate core theoretical knowledge of graph theory to solve problems as case study method.	A4 (Organising Values)	Case Study/ Problem based learning	3. Assignment 4.Case Study Method 5.Innovative and Creative Assignment

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>											
	<b>CLO 2</b>											
	<b>CLO 3</b>											
	<b>CLO 4</b>											
11	<b>Transferable skills</b>			1	Critical Thinking Skills							
				2	Digital Skills							
				3	Entrepreneurial Skill							

12	<b>Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.,)** F2F-Face to Face; NF2F-Non Face to Face</b>											
	<b>Course Content outline</b>			<b>CLO</b>	<b>Teaching-Learning Activities</b>						<b>SLT</b>	
					Guided Learning (F2F)		<b>E-Learning</b>		Independent Learning			

									(NF2F)	
			L	T	P	O	Total			
Unit I	<b>Graphs and Subgraphs</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Definition and Example</li><li>• Degrees</li><li>• Subgraphs</li><li>• Isomorphism</li><li>• Ramsey Numbers</li><li>• Independent Sets</li><li>• Coverings</li><li>• Intersection Graphs and Line Graphs</li><li>• Matrices and Operations on Graphs</li></ul>	CLO 1	9	2	-	-	11	-	11	22
Unit II	<b>Degree Sequences</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Degree Sequences</li><li>• Graphic Sequences</li></ul> <b>Connectedness</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Walks, Trials and Paths</li><li>• Connectedness and Components</li><li>• Blocks</li><li>• Connectivity</li></ul>	CLO 1	8	2	-	-	10	-	10	20
Unit III	<b>Planarity</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Definition and Properties</li><li>• Characterization of Planar Graphs</li><li>• Thickness, Crossing and Outer Planarity</li></ul>	CLO 1	8	2	-	-	10	-	10	20
	Study graph theory concepts as a digital report.	CLO2	-	-	-	2	2			2

<b>Unit IV</b>	<b>Colourability</b> • Introduction • Chromatic Number and Chromatic Index • The Five Colour Theorem • Chromatic Polynomials	CLO 3	8	2	-	-	10	-	10	20
<b>Unit V</b>	<b>Directed Graphs</b> • Introduction • Definition and Basic Properties • Paths and Connections • Digraphs and Matrices • Tournaments	CLO 3	8	2	-	-	10	-	10	20
	Integrate core theoretical knowledge of graph theory to solve problems as case study method.	CLO4	-	-	-	2	2			2
<b>Total</b>			41	10	-	4	55		51	106

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	KWL (CLO 2)	5%	-	3	3
	Digital Report (CLO 2)	5%	-	3	3
	Assignment (500 words) (CLO4)	5%	-	3	3
	Case Study Method (CLO 4)	5%	-	3	3
	Innovative and Creative Assignment (CLO 4) (1000 words)	5%	-	6	6
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>7</b>	<b>39</b>	<b>46</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - TSLT (12+13+14)</b>					<b>164</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1. Arumugam. S, Ramachandran. S. (2014). <i>Invitation to Graph Theory</i> , Scitech Publications (India) Pvt. Ltd. Unit I Chapter 2 Page No. 5 – 25 Unit II Chapter 3 & 4 Page No.29 – 45 Unit III Chapter 8 Page No.73 -82			



		Unit IV Chapter 9 Page No.85 – 93 Unit V Chapter 10 Page No.99 - 109
17	<b>Additional References</b>	1. Bondy, J.A., Murty, U.S.R. <i>Graph Theory with Applications</i> , Elsevier Science Publishing Co.Inc. 2. Harary, F. (1971). <i>Graph Theory</i> . Addison-Wesley.
18	<b>Theory and Problems</b>	Theory : 80% Problems : 20%
19	<b>Recommended by BOS</b>	<b>Date</b> : 06.05.2023
20	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>

**Course Coordinators : Mrs. Umamaheswari. K  
Dr. Buvaneswari. R**

**Board Chairman**  
**(Seal and Signature with date)**

1	Name of the Course	Practical - Data Analysis using Python	
2	Course Code	22MAU28	
3	Course Type	Practical	Focus on Skill Development
4	Synopsis/Rationale of the Module	This Practical / Laboratory course is designed to provide the students with the knowledge to prepare their own documents in different environments. In addition, the students will learn how to apply and built their confidence to work in Python.	
5	Semester and Year Offered	Sem VI; Year III	
6	Credit Value	3	
7	Pre-requisite (if any)	Knowledge on Basic Statistics and Mathematics	
8	Assessment Strategy	50% External and 50%Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	CLO	Statements	Level of Taxonomy	Teaching Method	Mode of Assessments
	CLO1	Show various types of lists, Slicing, Dictionaries, tuples, functions, array in python.	P2 (Set)	Practical/ Demonstration	Practical Tests
	CLO2	Construct different types of charts and central tendency	P3 (Guided Response)	Practical/ Demonstration	Practical Tests
	CLO3	Build hypothesis testing for large and small sample test.	P4 (Mechanism)	Practical/ Demonstration	Practical Tests

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Practical skills- PLO 3; CLO 2- Practical skills; PLO 3, CLO 3 -practical skills-PLO3</b>											
	CLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO8	PLO 9	PLO 10	PLO 11
	CLO1			✓								
	CLO2			✓								
	CLO3			✓								

11	Transfer able skills	1	Practical Skill
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12	<b>Distribution of Student Learning Time&gt;(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face</b>			
	Course Content Outline	CLO	Teaching-Learning Activities	SLT

			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
			L	T	P	O	Total			
Exp 1	<b>Python Basics</b> List, Slicing, Dictionaries, tuples, functions, array	CLO 1	-	-	2	-	2	-	-	2
Exp 2	<b>Python Packages</b> Pandas, Numpy, Sci-kit Learn, matplotlib	CLO 1	-	-	2	-	2	-	-	2
Exp 3	<b>Importing Data</b> Reading, saving, Loading, writing, CSV, Excel, and text files,	CLO 1	-	-	2	-	2	-	-	2
Exp 4	<b>Manipulating Data</b> Selecting rows and columns, Merging data, data aggregation	CLO 1	-	-	2	-	2	-	-	2
Exp 5	<b>Statistics Basics</b> Central Tendency – Mean, median, mode, skewness	CLO 1	-	-	2	-	2	-	-	2
Exp 6	<b>Visual Representation</b> Histogram, Frequency polygon	CLO 2	-	-	2	-	2	-	-	2
Exp 7	<b>Visual Representation</b> Pie, Bar chart	CLO 2	-	-	2	-	2	-	-	2
Exp 8	<b>Visual Representation</b> Box and whisker plot	CLO 2	-	-	2	-	2	-	-	2
Exp 9	<b>Hypothesis Testing</b> One sample Proportion	CLO 2	-	-	2	-	2	-	-	2
Exp 10	<b>Hypothesis Testing</b> Two sample t test ( $\sigma_1^2$ and $\sigma_2^2$ unknown, assumed equal)	CLO 2	-	-	2	-	2	-	-	2
Exp 11	<b>Hypothesis Testing</b> Two sample Proportion test	CLO 3	-	-	2	-	2	-	-	2
Exp 12	<b>Hypothesis Testing</b> Two sample t test ( $\sigma_1^2$ and $\sigma_2^2$ unknown, assumed Unequal)	CLO 3			3		3	-	-	3
Exp 13	<b>Hypothesis Testing</b> Paired t test	CLO 3			3		3	-	-	3
Exp	<b>Hypothesis Testing</b>	CLO 3			2		2	-	-	2

14	Two Sample Variances								
Exp 15	Hypothesis Testing One Way ANOVA	CLO 3			3		3	-	-
	<b>Total</b>		-	-	<b>33</b>	-	<b>33</b>	-	<b>33</b>

13	Continuous Assessment	Percentage (%)	F2F(hours)	NF2F(hours)	SLT
	Practical Test 1	10%	1	3	4
	Practical Test 2- Poster Presentation (With relevant to the topic with example)	5%	1	3	4
	Practical Test 3	5%	1	3	4
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>10</b>	<b>30</b>	<b>40</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -SLT (12+13+14)</b>					<b>85</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	Python			
16	References	1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc."			
17	Additional References	2. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.			
18	Theory and Problems	Problems : 100%			
19	Recommended by BOS	Date :			
20	Approved by Academic Council	Resolution No. Date:			

Course Coordinator: Dr. Esha Raffie B

Board Chairman  
(Seal and Signature with date)

1	Name of the Course	Practical - Data Analysis using R Programming	
2	Course Code	22MAU29	
3	Course Type	Practical	Focus on Skill Development
4	Synopsis/Rationale of the Module	This Practical / Laboratory course is designed to provide the students with the knowledge to prepare their own documents in different environments. In addition, the students will learn how to apply and built their confidence to work in R programming.	
5	Semester and Year Offered	Sem VI; Year III	
6	Credit Value	2	
7	Pre-requisite (if any)	Knowledge on Basic Statistics and Mathematics	
8	Assessment Strategy	50% External and 50%Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO1</b>	Show various types of Logical comparison and bivariate plot	P2 (Set)	Practical/ Demonstration	Practical Tests
	<b>CLO2</b>	Construct different types random sampling	P3 (Guided Response)	Practical/ Demonstration	Practical Tests
	<b>CLO3</b>	Build discrete and continuous distributions	P4 (Mechanism)	Practical/ Demonstration	Practical Tests

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Practical skills- PLO 3; CLO 2- Practical skills; PLO 3, CLO 3 -practical skills-PLO3</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO1</b>			✓								
	<b>CLO2</b>			✓								
	<b>CLO3</b>			✓								

11	Transfer able skills	1	Practical Skill
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12	<b>Distribution of Student Learning Time&gt;(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab &amp; Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face</b>			
	<b>Course Content Outline</b>	<b>CLO</b>	<b>Teaching-Learning Activities</b>	<b>SLT</b>

			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
			L	T	P	O	Total			
<b>Exp 1</b>	Calculations with Data Vectors: Addition, multiplication, division, power operators	CLO 1	-	-	2	-	2	-	-	2
<b>Exp 2</b>	Bivariate plot: Scatter plot	CLO 1	-	-	2	-	2	-	-	2
<b>Exp 3</b>	Logical operation and comparisons	CLO 1	-	-	2	-	2	-	-	2
<b>Exp 4</b>	Simple random sampling without replacement	CLO 1	-	-	2	-	2	-	-	2
<b>Exp 5</b>	Simple random sampling with replacement	CLO 1	-	-	2	-	2	-	-	2
<b>Exp 6</b>	Relative frequency and probability of an event	CLO 2	-	-	2	-	2	-	-	2
<b>Exp 7</b>	Factorial function, permutation, Combinations in R	CLO 2	-	-	2	-	2	-	-	2
<b>Exp 8</b>	Skewness and kurtosis	CLO 2	-	-	2	-	2	-	-	2
<b>Exp 9</b>	Quantiles, Deciles, percentiles	CLO 2	-	-	2	-	2	-	-	2
<b>Exp 10</b>	Binomial distribution in R	CLO 2	-	-	2	-	2	-	-	2
<b>Exp 11</b>	Poisson distribution in R	CLO 3	-	-	2	-	2	-	-	2
<b>Exp 12</b>	Geometric distribution in R	CLO 3			3		3	-	-	3
<b>Exp 13</b>	Uniform distribution in R	CLO 3			3		3	-	-	3
<b>Exp 14</b>	Normal distribution in R	CLO 3			2		2	-	-	2
<b>Exp 15</b>	Exponential distribution in R	CLO 3			3		3	-	-	3
<b>Total</b>			-	-	33	-	33	-	-	33

13	Continuous Assessment	Percentage (%)	F2F(hours)	NF2F(hours)	SLT
	Practical Test 1	10%	1	3	4
	Practical Test 2- Poster Presentation (With relevant to the topic with example)	5%	1	3	4
	Practical Test 3	5%	1	3	4

	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>10</b>	<b>30</b>	<b>40</b>
<b>14</b>	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total -SLT (12+13+14)</b>					<b>85</b>
<b>15</b>	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	R software			
<b>16</b>	<b>References</b>	1. Introduction to Statistics and Data Analysis with Exercises, Solutions and Applications in R Authors: Heumann, Christian, Schomaker, Michael, Shalabh, Publisher" Springer 2016			
<b>17</b>	<b>Additional References</b>	3. A Beginner's Guide to R (Use R) By Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Springer 2009			
<b>18</b>	<b>Theory and Problems</b>	Problems : 100%			
<b>19</b>	<b>Recommended by BOS</b>	<b>Date :</b>			
<b>20</b>	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>			

Course Coordinator: Dr. Esha Raffie B

**Board Chairman**  
(Seal and Signature with date)

1	<b>Name of the Course</b>	<b>Numerical Methods</b>	
2	<b>Course Code</b>	22MAU30	
3	<b>Course Type</b>	Theory	Focus On – <b>Employability</b>
4	<b>Synopsis/Rationale of the Module</b>	Numerical Methods provides an introduction to basic concepts and techniques for finding numerical solutions of system of algebraic and transcendental equation. This course develops the problem solving skill for both theoretical and computational oriented problems.	
5	<b>Semester and Year Offered</b>	VI Sem; Year III	
6	<b>Credit Value</b>	3	
7	<b>Pre-requisite (if any)</b>	A pass in HSC	
8	<b>Assessment Strategy</b>	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Solve algebraic and transcendental equations.	C3 (Apply)	Lecture/Tutorial	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 2</b>	Formulate the numerical algebraic and Transcendental equation as an assignment	A4 (Organising Values)	Case study/Assignments	1.Project Report 2.Assignment
	<b>CLO 3</b>	Estimate the finite differences and interpolation	C5 (Evaluate)	Lecture/Tutorial/Case study	<b>CIA &amp; FINAL EXAM</b>
	<b>CLO 4</b>	Generalize finite differences and interpolation as an assignment	A4 (Organising Values)	Case study/Assignments	3..TCO 4. Case Study Assignment 5.Journal Writing

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.,)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>											
	<b>CLO 2</b>											
	<b>CLO 3</b>											
	<b>CLO 4</b>											

11	<b>Transferable skills</b>	1	Critical Thinking Skill
		2	Lifelong learning Skill
		3	Numeracy Skill



12	Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face									
	Course Content outline	CLO	Teaching-Learning Activities						SLT	
			Guided Learning (F2F)					E-Learning	Independent Learning (NF2F)	
L	T	P	O	Total						
Unit I	<b>The Solution of Numerical Algebraic and Transcendental Equation:</b> <ul style="list-style-type: none"><li>• The Bisection Method</li><li>• Iteration method</li><li>• RegulaFalsi Method</li><li>• Newton-Raphson Method</li></ul>	CLO 1	8	2	-	-	10	-	5	15
Unit II	<b>Solution of Simultaneous Linear Algebraic Equations</b> <ul style="list-style-type: none"><li>• Gauss –Elimination Method</li><li>• Gauss-Jordan Elimination Method</li><li>• Method of Triangularization</li><li>• Iterative Methods</li><li>• Jacobi method of iteration</li><li>• Gauss-Seidel method of iteration</li></ul>	CLO 1	8	2	-	-	10	-	5	15
Unit III	<b>Numerical Differentiation</b> <ul style="list-style-type: none"><li>• Newton’s forward difference formula to get the derivative</li><li>• Newton’s backward difference formula to get the derivative</li><li>• Derivative using Stirling’s formula</li><li>• To find maxima and minima of the function given the tabular values</li></ul>	CLO 1	8	2	-	-	10	-	-	10

	Formulate the numerical algebraic and Transcendental equation as an assignment	CLO 2	-	-	-	3	3	-	-	3
<b>Unit IV</b>	<b>Numerical Integration</b> • Newton-cote's formula • Trapezoidal rule • Simpson's one-third rule • Simpson's three-eighths rule	CLO 3	8	2	-	-	10	-	-	10
<b>Unit V</b>	<b>Numerical Solution of Ordinary Differential Equations</b> • Taylor's series method • Euler's Method • Improved Euler method • Modified Euler method	CLO 3	8	2	-	-	10	-	-	10
	Generalize finite differences and interpolation as an assignment	CLO 4				2	2	-	-	2
	<b>Total</b>		<b>40</b>	<b>10</b>	<b>-</b>	<b>5</b>	<b>55</b>	<b>-</b>	<b>10</b>	<b>65</b>

13	Continuous Assessment	Percentage (%)	F2F (hours)	NF2F (hours)	SLT
	Project Report(CLO2)	5%	-	3	3
	Assignment (500 words) (CLO2)	5%	-	3	3
	TCO(CLO4)	5%	-	3	3
	Case Study Assignment (CLO4)	5%	-	3	3
	Journal Writing (CLO4)	5%	-	6	6
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total(Continuous Assessment/Internal)</b>	<b>50%</b>	<b>7</b>	<b>39</b>	<b>46</b>
14	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - TSLT (12+13+14)</b>					<b>123</b>
15	Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)	NIL			
16	References	1.Kandasamy, P. Thilagavathi, K., Gunavathi, K. (1997).			

		<i>Numerical Methods</i> . S.Chand and Company Ltd.
17	<b>Additional References</b>	1. Venkataraman, M.K. (2009). <i>Numerical Methods in Science and Engineering</i> . National Publishing Company. 2. Kandasamy, P., Thilagavathi, K. (2014). <i>Allied Mathematics paper-1</i> , S.Chand and Company Ltd.
18	<b>Theory and Problems</b>	Theory : 20% Problems : 80%
19	<b>Recommended by BOS</b>	<b>Date:</b> 06.05.2023
20	<b>Approved by Academic Council</b>	<b>Resolution No.</b> <b>Date:</b>

**Course Coordinator: Ms. Sathyapriya. S**

**Board Chairman**  
**(Seal and Signature with date)**

1	Name of the Course	Discrete Mathematics	
2	Course Code	22MAU31	
3	Course Type	Theory	Focus On –Employability
4	Synopsis/Rationale of the Module	This course provides students with a basic understanding towards developing a strong background on modelling, formulation and solving discrete structure problems.	
5	Semester and Year Offered	VI Sem; Year III	
6	Credit Value	3	
7	Pre-requisite (if any)	Knowledge in Logics, relations and algebraic Structures	
8	Assessment Strategy	50% External, and 50% Internal	

9	<b>Course Learning Outcomes (write the statement of the course learning outcomes)</b> At the end of the course the students will be able to:				
	<b>CLO</b>	<b>Statements</b>	<b>Level of Taxonomy</b>	<b>Teaching Method</b>	<b>Mode of Assessments</b>
	<b>CLO 1</b>	Analyzethe concepts of Mathematical Logics and to construct the Disjunctive and Conjunctive normal forms and Examine the theory of inference for the statement calculus.	C4 Analysis	Lecture/ Tutorial	<b>CIA&amp; FINAL EXAM</b>
	<b>CLO 2</b>	Complete the Applications of Propositional Calculus as an Assignment.	A4 Organising Values	Case study Assignments	1. Assignment 2. Digital Report
	<b>CLO 3</b>	Explain the concept of relation and function to interpret issues in different areas of mathematics and Summarise theconcept of lattices, Sub lattices, Special lattices, graph and Matrix representation of Graphs.	C5 Evaluate	Tutorial/ Problem Based Learning	<b>CIA&amp; FINAL EXAM</b>
	<b>CLO 4</b>	Perform the problems on Lattices and Graph Theory as a case study method.	A5 Internalising Values	Case study Assignments	3.Case Study Method 4. Innovative and Creative Method 5.KWL

10	<b>Mapping CLO's with PLO's (select the learning domain for each CLO's and map it with PLO's; for example, CLO 1- Knowledge- PLO 1; CLO 2- Communication skills; PLO 4 etc.)</b>											
	<b>CLO</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>	<b>PLO 7</b>	<b>PLO 8</b>	<b>PLO 9</b>	<b>PLO 10</b>	<b>PLO 11</b>
	<b>CLO 1</b>		√									
	<b>CLO 2</b>						√					
	<b>CLO 3</b>		√									
	<b>CLO 4</b>										√	

11	<b>Transferable skills</b>	1	Critical Thinking
		2	Digital Skills
		3	Entrepreneurial Skill

12		Distribution of Student Learning Time-(*SLT-Students Learning Time; L-Lecture; T-Tutorial; P-Practical (Lab & Demonstration); O-Others i.e. case study, Problem based learning, Group discussion learning etc.)** F2F-Face to Face; NF2F-Non Face to Face	Course Content outline	CLO	Teaching-Learning Activities						SLT	
					Guided Learning (F2F)					E-Learning		Independent Learning (NF2F)
					L	T	P	O	Total			
Unit I	<b>Relations and Ordering:</b> <ul style="list-style-type: none"><li>Relations- Properties of Binary relations in a set</li><li>Equivalence relations.</li><li>Composition of Binary relation, Partial ordering.</li></ul> <b>Functions</b> <ul style="list-style-type: none"><li>Introduction and Definition</li><li>Composition of functions</li><li>Inverse functions</li></ul>	CLO 1	8	2	-	-	10	-	5	15		
Unit II	<b>Mathematical Logic</b> <ul style="list-style-type: none"><li>Propositions</li><li>Connectives</li><li>Conditional and Biconditional Operators</li><li>Converse, Inverse &amp; Contrapositive</li><li>Tautologies and Contradiction</li></ul>	CLO 1	8	2	-	-	10	-	5	15		
	Complete the Applications of Propositional Calculus as an Assignment	CLO 2				3	3			3		
Unit III	<b>Predicate Calculus</b> <ul style="list-style-type: none"><li>Argument</li><li>Methods of Proof</li><li>Equivalence and Implication</li><li>Predication Calculus</li></ul>	CLO 3	8	2	-	-	10	-	-	10		

	• Quantifiers									
Unit IV	<b>Lattices</b> • Lattices • Duality • Types of lattices • Distributes Lattices • Some Special Lattices	CLO 3	8	2	-	-	10	-	-	10
Unit V	<b>Languages and Grammar</b> • Languages • Operations on Languages • Power of Languages • Regular Expressions • Regular languages • Language of a Grammar • Types of Grammars	CLO 3	8	2	-	-	10		-	10
	Perform the problems on Lattices and Graph Theory as a case study method.	CLO 4				2	2			2
	<b>Total</b>		<b>40</b>	<b>10</b>		<b>5</b>	<b>55</b>		<b>10</b>	<b>65</b>

<b>13</b>	<b>Continuous Assessment</b>	<b>Percentage (%)</b>	<b>F2F (hours)</b>	<b>NF2F (hours)</b>	<b>SLT</b>
	Assignment(CLO2)	5%	-	3	3
	Digital Report(CLO2)	5%	-	3	3
	Case Study Method (CLO4)	5%	-	3	3
	Innovative and Creativity Method (CLO4)	5%	-	3	3
	KWL (CLO4)	5%	-	3	3
	CIA 1	7.5%	2	6	8
	CIA 2	7.5%	2	6	8
	CIA 3	10%	3	9	12
	<b>Total (Continuous Assessment/Internal)</b>	<b>50%</b>	<b>7</b>	<b>36</b>	<b>43</b>
<b>14</b>	<b>Final Exam/Summative Assessment/End Semester Exam</b>	<b>50%</b>	<b>3</b>	<b>9</b>	<b>12</b>
<b>Grand Total - TSLT (12+13+14)</b>					<b>120</b>
<b>15</b>	<b>Identify special requirements to deliver the course (Software, simulation room, computer lab etc.,)</b>	NIL			

16	References	<p>A. Sharma, J.K. (2012). <i>Discrete Mathematics</i>. Macmillan Publishers India limited.</p> <p>Unit I Chapter 3 &amp; 4 Section 3.1-3.6 &amp; 4.1-4.4 Page No. 78-90 &amp; 109-116</p> <p>Unit II Chapter 12 Section 12.1 -12.10 Page No. 392-416</p> <p>Unit III Chapter 12 Section 12.11-12.15 Page No. 417-434</p> <p>Unit IV Chapter 14 Section 14.5-14.8 Page No. 494-516</p> <p>Unit V Chapter 15 Section 15.1-15.5 Page No. 518-535</p>
17	Additional References	<p>A. Venkataraman, M.K. Sridharan, N., Chandrasekaran, N. (2011). <i>Discrete Mathematics</i>. The National Publishing Company.</p>
18	Theory and Problems	<p>Theory : 20%</p> <p>Problems : 80%</p>
19	Recommended by BOS	<b>Date:</b> 06.05.2023
20	Approved by Academic Council	<b>Resolution No.</b> <b>Date:</b>

Course Co-ordinator: Ms. DURGA DEVI S

**Board Chairman**  
(Seal and Signature with date)