Department of Mathematics

Course Structure (w.e.f. 2021)

Semester I

Part	Components	Sub. Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil French	21ULTA11 21ULFA11	,f;fhy ,yf;fpak; nra;As;> ,yf;fzk;> ,yf;fpa tuyhW> ciueil>rpWfij Introductory French Course	6	3	40	60	100
II	General English	21UGEN11	Poetry, Prose, Extensive Reading and Communicative English – I	6	3	40	60	100
III	Core I	21UMAC11	Classical Algebra	4	3	40	60	100
	Core II	21UMAC12	Calculus	4	3	40	60	100
	Allied I	21UPHA11	Allied Physics	4	3	40	60	100
	Allied Practical I	21UPHAR1	Allied Physics	2	--			
IV	Skill Enhancement Course – I	21UMAPE1	Professional English for Mathematics - I	2	2	20	30	50
	Ability Enhancement Course – I	21UAVE11	Value Education	2	2	20	30	50
Total				**30**	**19**			

Semester II

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil	21ULTA21	rka ,yf;fpaq;fSk; ePjp ,yf;fpaq;fSk;> nra;As; ,yf;fzk>; ,yf;fpa tuyhW> ciueil> tho;f;if tuyhW	6	3	40	60	100
	French	21ULFA21	Intermediate French Course					
II	General English	21UGEN21	Poetry, Prose, Extensive Reading and Communicative English – II	6	3	40	60	100
III	Core III	21UMAC21	Analytical Geometry of Three Dimensions	4	3	40	60	100
	Core IV	21UMAC22	Differential Equations	4	3	40	60	100
	Allied II	21UPHA21	Allied Physics II	4	3	40	60	100
	Allied Practical I	21UPHAR1	Allied Physics Practical	2	2	40	60	100
IV	Skill Enhancement Course – I	21UMAPE2	Professional English for Mathematics - II	2	2	20	30	50
	Ability Enhancement Course – II	21UAEV21	Environmental Studies	2	2	20	30	50
Total				**30**	**21**			

Semester III

Part	Components	Course Code	Course Title	Hrs/Wee	Credit	Max.Marks		
						CIA	ESE	Total
I	Tamil	21ULTA31	fhg;gpa ,yf;fpak;: nra;As;> ,yf;fzk;> ciueil> rpWfij> ,yf;fpa tuyhW	6	4	40	60	100
	French	21ULFA31	Advanced French Cour					
II	General English	21UGEN31	Poetry, Prose, Extensive Reading and Communicative English – III	6	4	40	60	100
III	Core V	21UMAC31	Sequences and Series, Trigonometry	6	5	40	60	100
	Allied III	21UMMA31	Statistics I	6	4	40	60	100
	Skill Based Elective	21UMAS31/ 21UMAS32	Introduction to Python Programming /Quantitative Aptitude - I	2	2	20	30	50
	NME I	21UMAN31	Mathematics for Competitive Examinations I	2	2	20	30	50
IV	Ability Enhancement Course – III	21UAWS31	Women's Synergy	2	2	20	30	50
	Self Study Course / /On-line Course/ Internship(Compulsory)	21UMASS1/	Fundamentals of Mathematics		+2		50	50
Total				**30**	**23+2**			

Semester IV

Part	Components	Course Code	Course Title	Hrs/Wk	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil	21ULTA41	rq;f ,yf;fpak:; nra;As;> ,yf;fzk;> ciueil> tho;f;if tuyhW> ,yf;fpa tuyhW	6	4	40	60	100
	French	21ULFA41	Language through Literature					
II	General English	21UGEN41	Poetry, Prose, Extensive Reading and Communicative English- IV	6	4	40	60	100
III	Core VI	21UMAC41	Modern Algebra	6	5	40	60	100
	Allied IV	21UMMA41	Statistics II	6	4	40	60	100
	Skill Based Elective	21UMAS41/ 21UMAS42	Documentation using LaTeX / Quantitative Aptitude-II	2	2	20	30	50
	NME II	21UMAN41	Mathematics for Competitive Examinations II	2	2	20	30	50
IV	Ability Enhancement Course – IV	21UAYM41	Yoga & Meditation	2	2	20	30	50
	Self Study / On-line Course/ Internship (Optional)	21UMASS2/ 21UMAM41/ 21UMAI41	Industrial Mathematics		+2		50	50
V	NCC, NSS & Sports				1			
	Extension Activities CDP				+1			
Total				**30**	**24+3**			

Semester V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
	Core VII (Common Core)	21UCMC51	Computer Oriented Numerical Methods	6	5	40	60	100
III	Core VIII	21UMAC51	Linear Algebra	5	4	40	60	100
	Core IX	21UMAC52	Graph Theory	5	4	40	60	100
	Core X	21UMAC53	Real Analysis	4	4	40	60	100
	Core XI	21UMAC54	Vector Calculus and Fourier Series	4	4	40	60	100
	Core Elective	21UMAE51/ 21UMAE52	Discrete Mathematics / Transforms	4	4	40	60	100
IV	Common Skill Based	21UCSB51	Computers for Digital Era and Soft Skills	2	2	20	30	50
	Self Study or On-line Course (Optional)	21UMASS3/ 21UMAM51	Astronomy	--	2		50	50
Total				**30**	**29**			

Semester VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core XII	21UMAC61	Complex Analysis	6	5	40	60	100
	Core XIII	21UMAC62	Modern Analysis	6	5	40	60	100
	Core XIV	21UMAC63	Mechanics	6	5	40	60	100
	Core XV	21UMAC64	Operations Research	6	5	40	60	100
IV	Core XVI / Project	21UMAC65/ 21UMAP61	Coding Theory/ Project	6	4	40	60	100
Total				**30**	**24**			
Total				**180**				

Lesson Plan

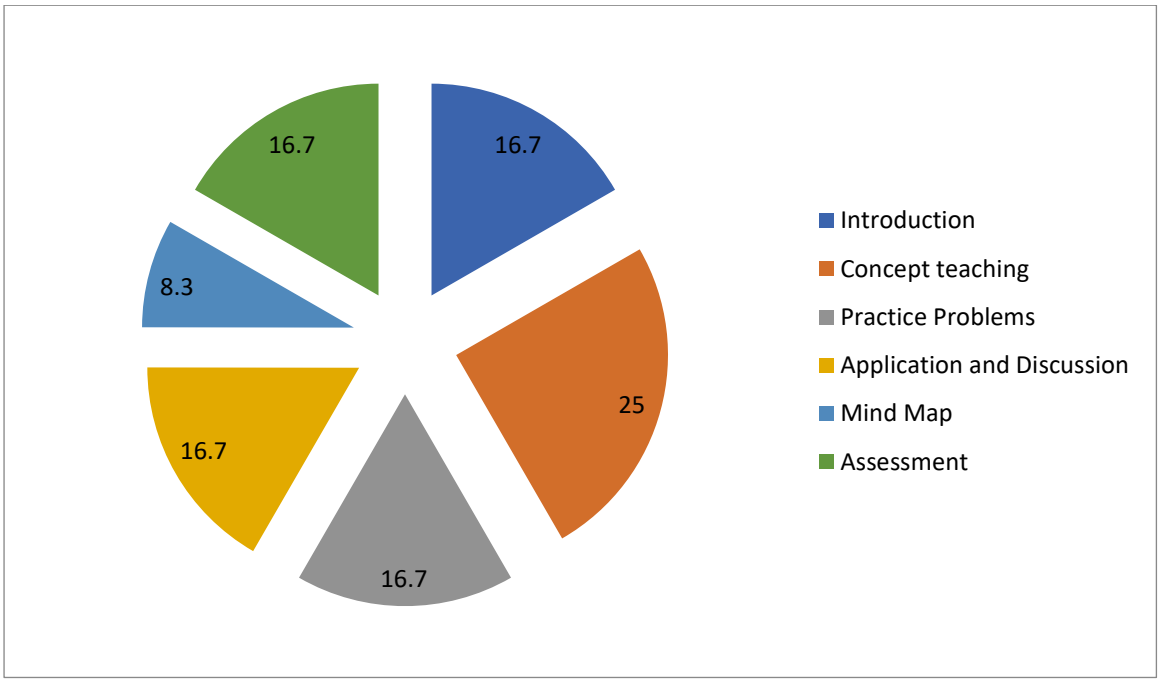
Programme	B. Sc Mathematics
Semester	I
Course Title	Classical Algebra
Code	21UMAC11
Hours	4
Total Hours	60
Credits	3
Max Marks	100
Unit & Title	Unit I : -Relations between the roots and coefficients of equations
Name of the Faculty	Dr.A.Punitha Tharani
T-L tools	Mind Maps, Project, Assignments, PPT

1. Pre-requisite Knowledge:

Basic understanding of

- Basic Algebraic Operations.
- Polynomial Equations.
- Factorization Techniques

2. Micro-Planning: (120 minutes)



3. Topics for Learning through Evocation

To engage students and stimulate curiosity before diving into the core lesson, introduce real-world and intuitive connections to the concept of roots and coefficients.

Topic Introduction:

To introduce the algebraic relationship between the roots of a polynomial equation and its coefficients

General Objective:

- To introduce the algebraic relationship between the roots of a polynomial equation and its coefficients.

- To explain how this relationship aids in forming polynomials and solving root-based problems.

1. Specific Objectives:

By the end of the lesson, students will be able to:

SO1: Recognize and state the standard form of a polynomial equation.

SO2: Derive and use Vieta's formulas for quadratic, cubic, and quartic equations.

SO3: Construct a polynomial given its roots.

SO4: Solve problems involving sums and products of roots and symmetric expressions.

2. Taxonomy of Objectives

Taxonomy of Objectives						
Knowledge Dimension	**TheCognitiveProcess Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
A.FactualKnowledge	1	1,2				
B.Conceptual Knowledge		2	3			
C.Procedural Knowledge			3			
D.Meta-Cognitive Knowledge						

Keywords:

- Polynomial Equation

- Roots of Equation
- Coefficients
- Vieta’s Formula
- Symmetric Functions
- Standard Form

1. **Key Diagrams:**
   - Expansion of $(x-\alpha)(x-\beta)$
   - Flowchart showing process of forming equations from roots
   - Table comparing root-coefficient relationships across degrees (quadratic, cubic)

2. **Discussion Topics:**

a) **Quadratic Equations:**

Sum and product of roots from $ax^2+bx+c=0$

Use: $\alpha+\beta=-\frac{b}{a}, \quad \alpha\beta=\frac{c}{a}$

b) **Cubic and Higher-Degree Equations:**

Discuss symmetric sums and general Vieta's relationships.

c) **Applications:**

- Forming equations from given roots
- Solving problems using root relations
- Role in mathematical modeling, coding theory, and numerical methods

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3. **Mind Map**

Visual showing connections: Equation → Roots → Sums/Products → Symmetric functions → Applications

4. **Summary**

This lesson introduced the vital connection between the roots and coefficients of polynomial equations, primarily through Vieta’s formulas. These relationships enable efficient problem-solving, help construct polynomials from known roots, and have broad applications in algebra and beyond.

5. Assessment Through Questions & New Ideas:

- **Formative:** In-class problem solving, quizzes, pair-share discussions
- **Summative:** Assignments on forming equations and solving root-based problems

6. FAQs (MCQs & Descriptive Questions):

a) What is the sum of roots of a quadratic equation?
b) Can we construct an equation if only the sum and product of roots are known?
c) How does Vieta's formula help in solving real problems?
d) What changes in the root-coefficient relation if all roots are doubled?

Powerpoint Presentation

https://gamma.app/docs/Unveiling-the-Secrets-Roots-and-Coefficients-k2tpv3zodxfr2zs

References:

1. Hall and Knight – Higher Algebra
2. Lial, Hornsby – College Algebra
3. R.D. Sharma – Algebra (for foundational practice)
4. Online algebra learning platforms like Khan Academy and Paul's Online Math Notes

Verified by Subject Expert:

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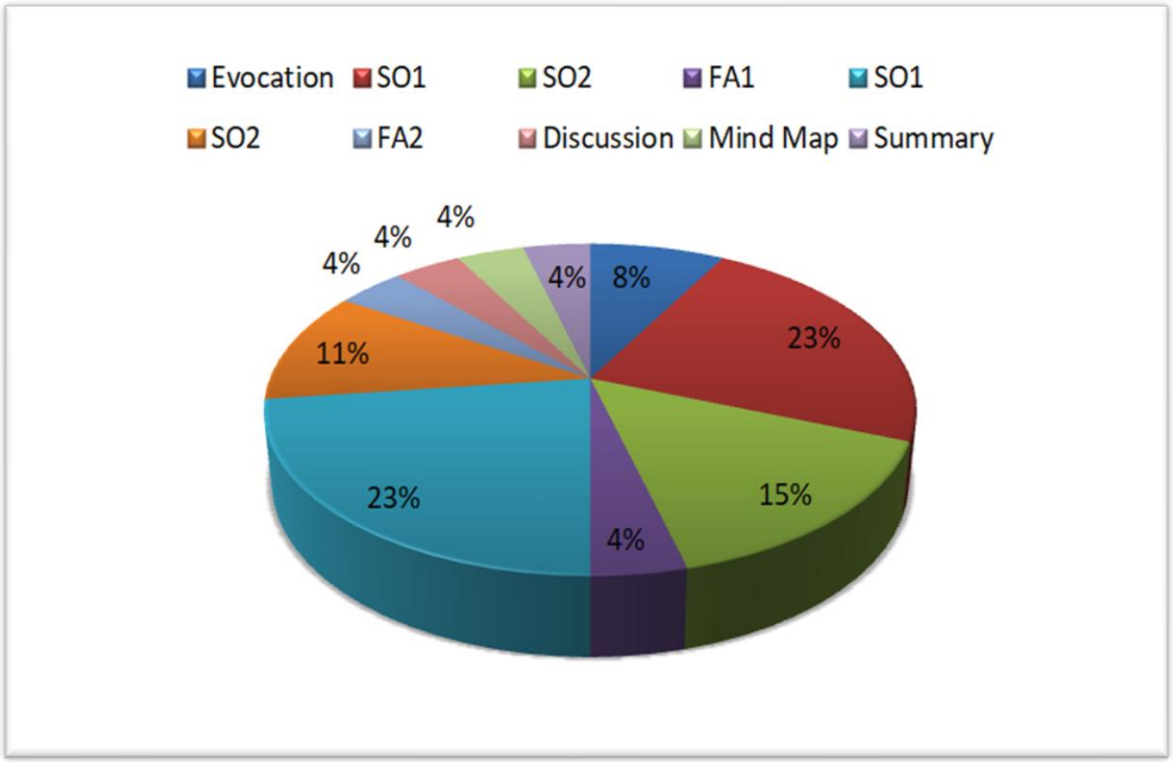
Lesson Plan

Programme	B. Sc. Mathematics
Semester	I
Course Title	Calculus
Code	21UMAC12
Hours	4
Total Hours	60
Credits	3
Max Marks	100
Unit & Title	Unit IV: Double & Triple Integrals
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Maps, Art Project, Think-Pair-Share

Pre-requisite Knowledge:

Basic understanding of single-variable integration, knowledge of coordinate geometry, and familiarity with fundamental calculus concepts.

Micro-Planning: (120 minutes)



Topics for Learning through Evocation (10 Min)

- Introduction to multiple integrals
- Applications in geometry and physics
- Understanding integration over regions in two and three dimensions

General Objective:

To develop students' analytical skills in evaluating double and triple integrals and applying them to real-world problems in physics and engineering.

Specific Outcomes:

- **SO1:** Evaluate double integrals over rectangular and general regions.
- **SO2:** Compute triple integrals in Cartesian, cylindrical, and spherical coordinates.

First Phase:

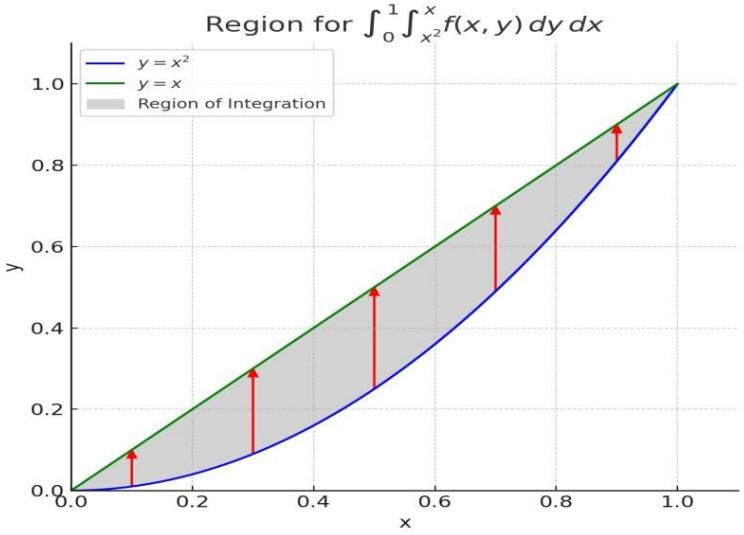
- **SO1:** Understanding the concept of double integration (30 min)
- **SO2:** Evaluating double integrals in rectangular and polar coordinates (25 min)
- **FA1:** Solve basic double integral problems (5 min)

Second Phase:

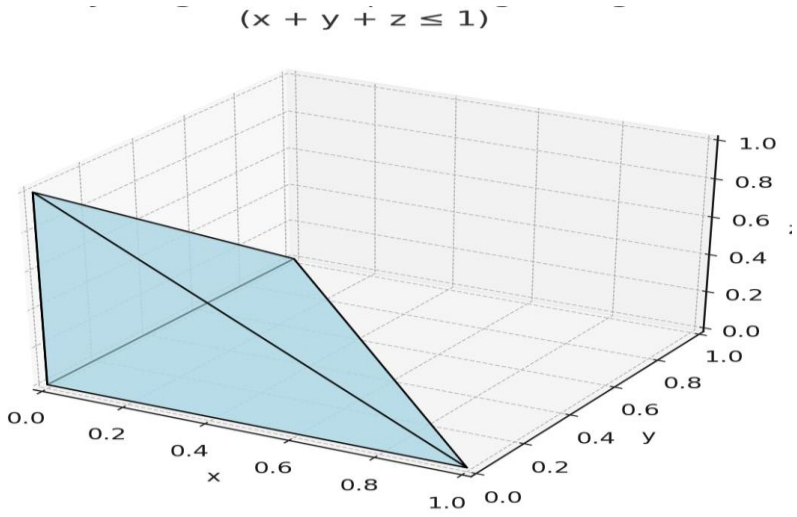
- **SO1:** Learning triple integrals and their applications (30 min)
- **SO2:** Evaluating triple integrals in different coordinate systems (20 min)
- **FA2:** Compute a sample triple integral (5 min)

Key Diagrams:

Double Integral Region



Triple Integral Region



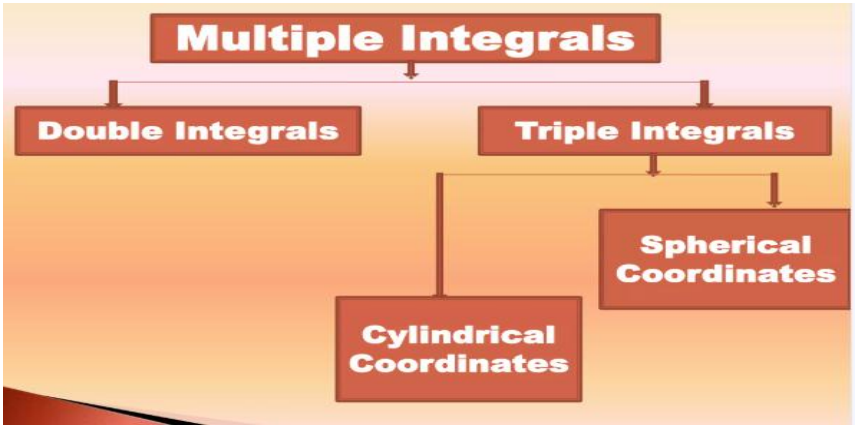
PowerPoint Presentation

https://docs.google.com/presentation/d/1ncUeip3n0Fb3aaqrOZqrKvMqusnm7aBP/edit?usp=drive_link&ouid=115291083755644247696&rtpof=true&sd=true

Discussion Topics:

- Application of multiple integrals in volume and mass calculations.
- Change of order of integration.
- Real-world problems involving multiple integration.

Mind Map (5 min):



Summary (5 min):

- Double integrals are used to calculate areas and volumes.
- Triple integrals extend the concept to three-dimensional space.

- Changing the order of integration simplifies complex calculations.
- Cylindrical and spherical coordinates help solve specific integral problems efficiently.

Assessment Through Questions & New Ideas:

- Compute a double integral over a given region.
- Solve a triple integral in spherical coordinates.
- Explain the physical interpretation of a given integral.
- Discuss real-world applications of multiple integrals.

FAQs (MCQs & Descriptive Questions):

1. What is the difference between double and triple integrals?
2. How do you change the order of integration?
3. What are the applications of multiple integrals in physics?
4. Why are cylindrical and spherical coordinates used in integration?
5. Solve and interpret the result.

References:

1. Stewart, James. *Calculus: Early Transcendentals*. Cengage Learning, 2020.
2. Thomas, George B., Maurice D. Weir, and Joel Hass. *Thomas' Calculus*. Pearson, 2018.
3. Apostol, Tom M. *Calculus: Volume II*. Wiley, 1991.

Verified by Subject Expert:

Course In-Charge

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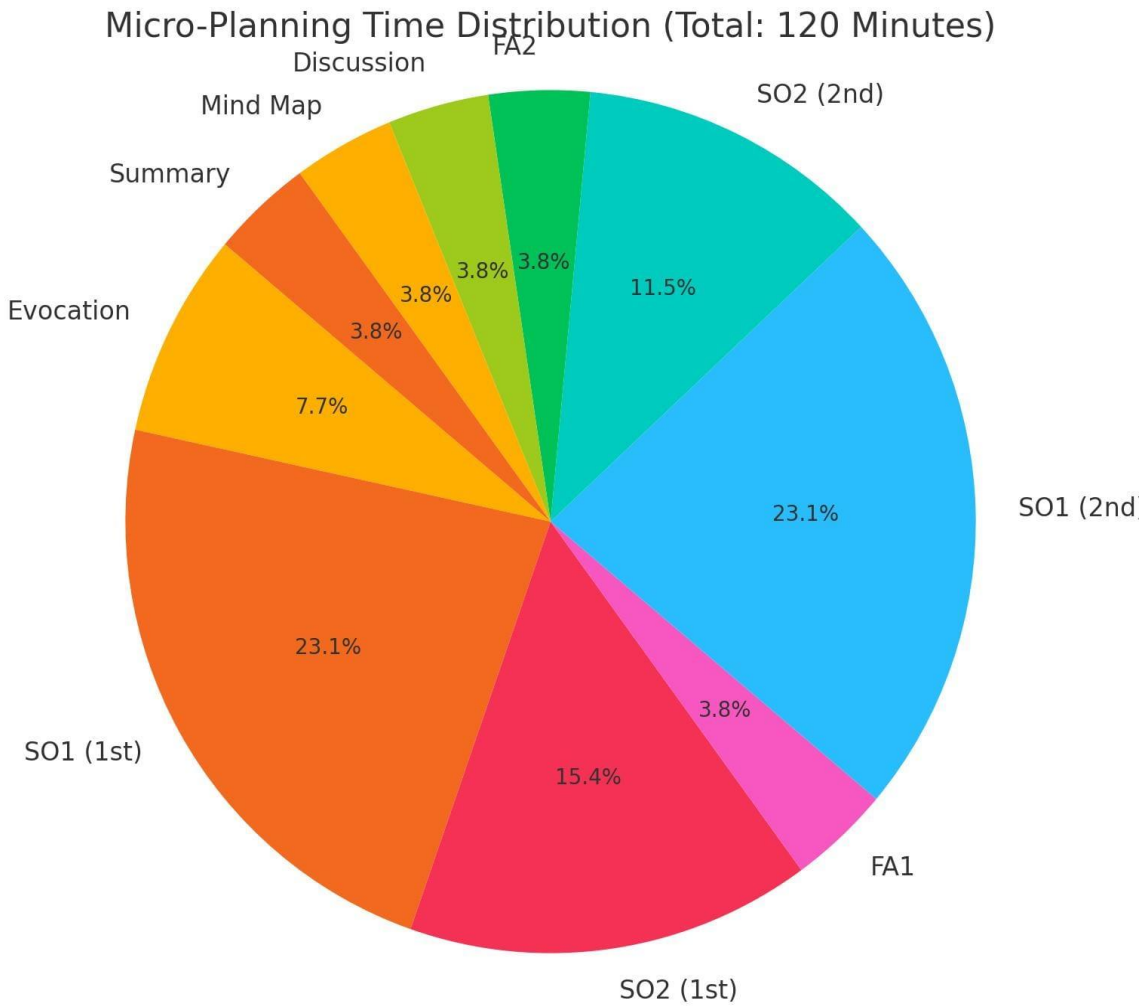
Lesson Plan

Programme	B. Sc Mathematics
Semester	II
Course Title	Analytical Geometry
Code	21UMAC21
Hours	4
Total Hours	60
Credits	4
Max Marks	75
Unit & Title	Unit V: Sphere and Its Properties
Name of the Faculty	Dr. J. Arul Jesti
T-L tools	Models, Diagram Illustrations, Problem-Solving Worksheets, Interactive Boards

Pre-requisite Knowledge

- Basic 3D geometry
- Distance formula
- Equation of a plane

Micro-Planning: (120 Minutes)



Topics for Learning through Evocation (10 Min)

- Introduction to spheres in real life (ball, bubble, globe)
- Visualizing sphere in 3D space

General Objective

To enable students to understand the geometric properties and analytical equations involving spheres and their interactions with planes and other spheres.

Specific Outcomes

- SO1: Derive and apply the equation of a sphere.
- SO2: Understand plane sections of a sphere.
- SO1: Find the tangent plane to a sphere at a given point.
- SO2: Analyze intersections involving two spheres and a plane with a sphere.

First Phase (SO1 & SO2)

- SO1: Equation of Sphere (30 min)
  Standard form, general form
  Center and radius from general form
- SO2: Plane Section of a Sphere (20 min)
  Circle of intersection
  Derivation and properties
- FA1: Find the center and radius of a given sphere equation (5 min)

Second Phase (SO1 & SO2)

- SO1: Tangent Line to a Sphere (30 min)
  Equation of tangent plane at a point
  Applications in physics and geometry
- SO2: Intersection of Two Spheres (15 min)
  Resulting circle
  Equation of plane of intersection
  Intersection of a Plane with a Sphere (10 min)
  Equation of circle formed
  Conditions for intersection
- FA2: Problem-solving – find tangent plane to a sphere at a given point (5 min)

Discussion Topics (5 Min)

- Applications of tangent planes in 3D modeling
- Use of sphere intersections in engineering and GPS systems

Mind Map (5 Min)

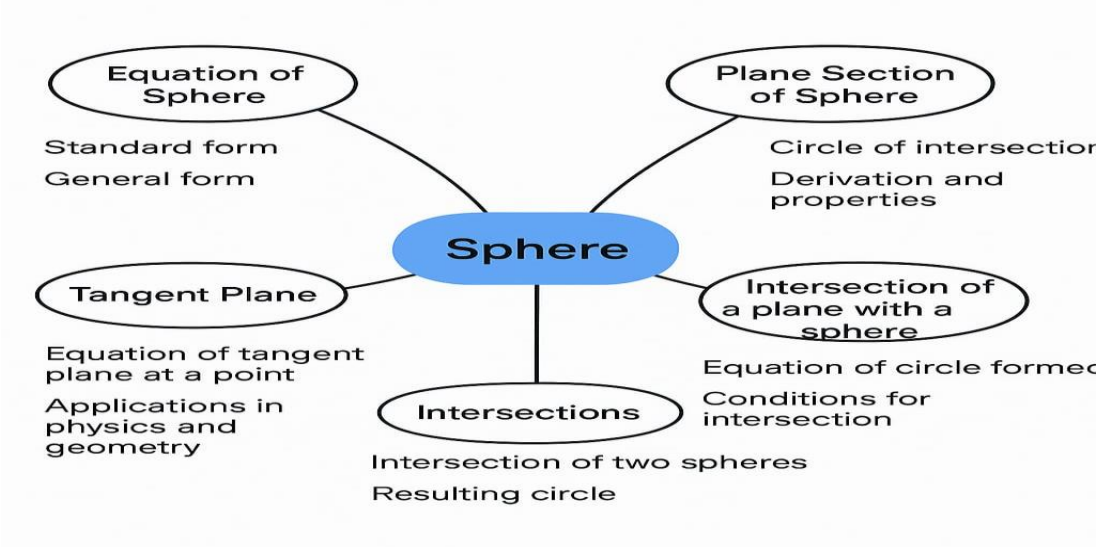
Central Theme: Sphere

Branch 1: Equation of Sphere

Branch 2: Plane Section

Branch 3: Tangent Plane

Branch 4: Intersections



Summary (5 Min)

- Spheres are defined by a center and radius in 3D space.
- A plane can cut a sphere to form a circle.
- The tangent plane touches the sphere at one point.
- Intersecting spheres or planes with spheres gives rise to circles under certain conditions.

Assessment Through Questions & New Ideas

- Derive the standard form of the sphere equation.
- Find the equation of the tangent plane to a sphere at a point.
- Determine the condition for two spheres to intersect.
- Explain the geometric interpretation of a plane section of a sphere.

FAQs (MCQs & Descriptive)

- 1. What is the general form of a sphere?
- 2. How do you find the radius and center of a sphere from its equation?
- 3. What is the condition for two spheres to intersect in a circle?
- 4. How do you find the intersection of a plane with a sphere?
- 5. Write the equation of the tangent plane to a sphere at point $P(x_1, y_1, z_1)$.

References

1. P. Durai Pandian – Analytical Geometry.
2. M.L. Khanna – Coordinate Geometry.
3. Grewal – Higher Engineering Mathematics.

Verified by Subject Expert:

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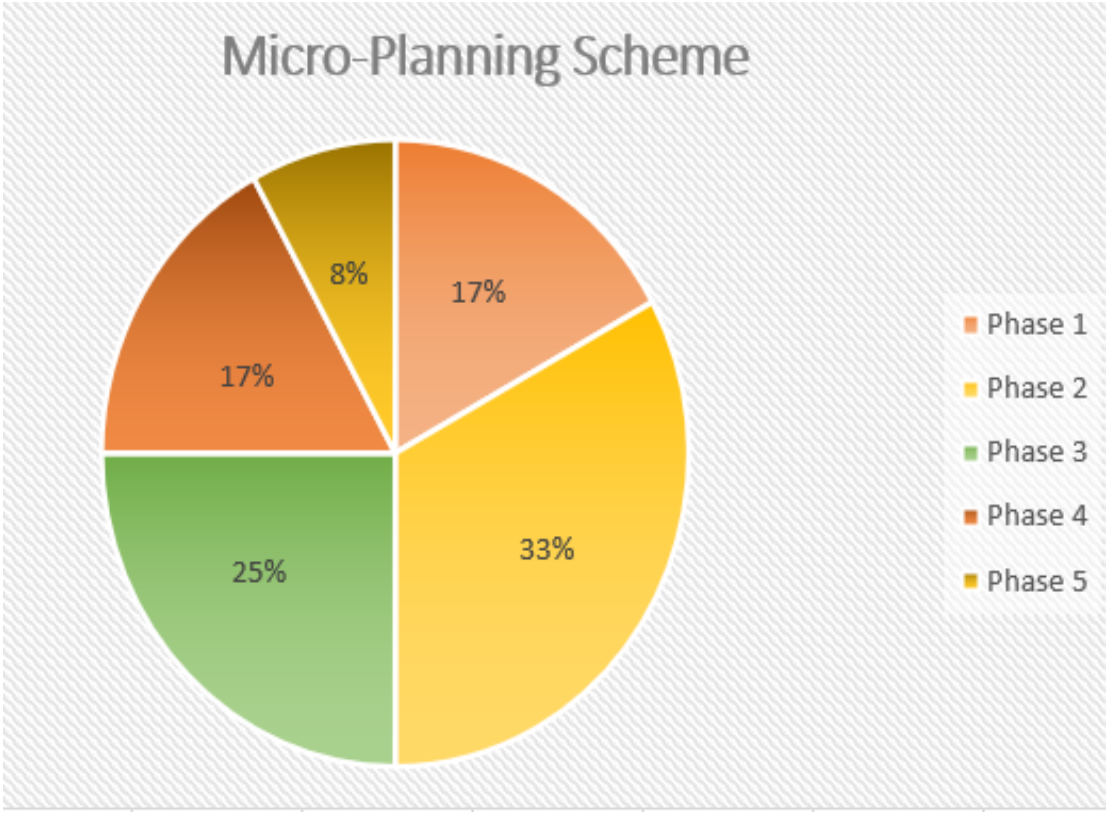
Lesson Plan

Programme	B.Sc. Mathematics
Semester	II
Course Title	Differential Equations
Code	21UMAC22
Hours	4
Total Hours	60
Credits	3
Max Marks	100
Unit & Title	Unit II: Linear Equations with constant coefficients
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Maps, Think-Pair-Share

Pre-requisite Knowledge

- Understanding of basic differentiation and integration
- Knowledge of first-order differential equations.

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Definition and basic form of linear differential equations with constant coefficients	10 min
Phase 2: Solution Methods	Finding complementary function (CF) and particular integral (PI)	20 min
Phase 3: Special Cases	Equations with repeated roots, distinct roots, and complex roots	15 min
Phase 4: Applications & Discussion	Real-world applications in physics and engineering	10 min
Phase 5: Assessment & Recap	Quick quiz and summary of key points	5min

1.Topics for Learning through Evocation

- Discuss real-life phenomena modelled by linear differential equations (e.g., electrical circuits, population growth)
- Ask students to identify where they have encountered differential equations before.

2.Topic Introduction

2.1: General Objectives:

- To introduce linear differential equations with constant coefficients and their significance in mathematical modelling
- To understand solution techniques and applications

2.2: Specific Outcomes:

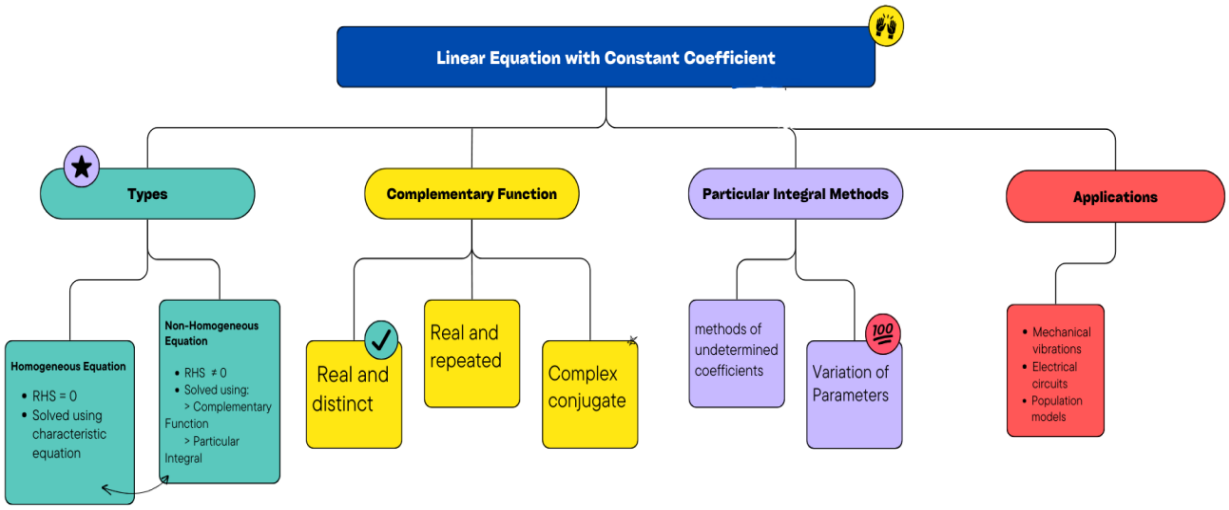
- **SO1**: Understand the standard form of linear differential equations
- **SO2**: Apply methods to find the complementary function and particular integral
- **SO3**: Solve problems involving special cases such as repeated and complex roots

2.3: Discussion & Student Engagement (10 minutes)

- Provide real-world examples of differential equations in science and engineering
- Use interactive activities like solving an equation in groups and discussing applications

Mind Map (2 minutes)

- Visual representation of key concepts: General solution, complementary function, particular integral, different types of roots



Summary (2 minutes)

Linear differential equations with constant coefficients play a significant role in mathematical modelling and applications. The general solution consists of a **complementary function (CF)** and a **particular integral (PI)**. Depending on the nature of the characteristic roots (distinct, repeated, or complex), the solution takes different forms. The method of undetermined coefficients or variation of parameters helps determine the particular integral. These equations are widely applied in physics (e.g., oscillations, circuits), engineering (e.g., control systems), and other scientific disciplines. Mastering these techniques equips students with essential problem-solving skills for advanced mathematical analysis.

2.4: Taxonomy of Objectives

Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	2	1				
B. Conceptual Knowledge			2	1		
C. Procedural Knowledge					2	1
D. Meta Cognitive Knowledge						

3.Key Terms:

- Linear Differential Equations
- Constant Coefficients
- Complementary Function (CF)
- Particular Integral (PI)
- Characteristic Equation
- Homogeneous and Non-Homogeneous Equations

4. Powerpoint Presentation

https://docs.google.com/presentation/d/1-2utEOaBjYzHZ33ZS4HyTbhjo7X5KdHM/edit?usp=drive_link&ouid=115291083755644247696&rtpof=true&sd=true

5.Assessment Through Questions/Analogy/New Ideas:

- **FA1:** Given a differential equation, determine its complementary function
- **FA2:** Solve for the particular integral using an appropriate method

6.FAQs & Discussion Questions:

1. Define a linear differential equation with constant coefficients.
2. Explain the steps to find the complementary function.
3. What happens when the characteristic equation has repeated roots?
4. Describe a real-world problem that can be modelled using these equations.

7.References:

1. **Boyce, W. E., & DiPrima, R. C.***Elementary Differential Equations and Boundary Value Problems.* Wiley, 2017.
2. **Simmons, G. F.***Differential Equations with Applications and Historical Notes.* McGraw-Hill, 1991.
3. **Kreyszig, E.** *Advanced Engineering Mathematics.* Wiley, 2011.

8. Verified by subject Expert:

Course In-charge

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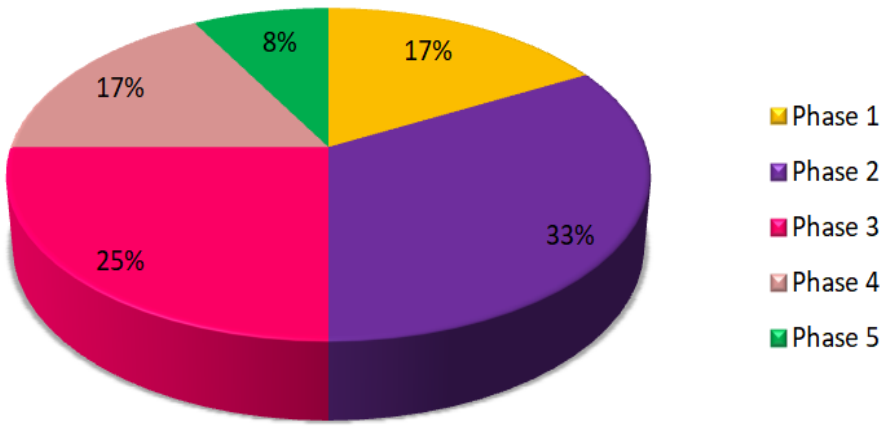
Lesson Plan

Programme	B.Sc. Mathematics
Semester	III
Course Title	Sequences and Series, Trigonometry
Code	21UMAC31
Hours	6
Total Hours	90
Credits	5
Max. Marks	100
Unit & Title	Unit II: Sequences
Name of the Faculty	Dr. Sr. S. Kulandai Therese
T-L tools	Mind Maps, Group Discussion, Think-Pair-Share

Pre-requisite Knowledge

- Basic concepts of limits.
- Understanding of functions and algebraic expressions

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Definition and examples of sequences.	10min
Phase 2: Exploration	Convergent, divergent, and oscillating sequences.	20min
Phase 3: Theorems and Properties	Limit theorems, monotonic and bounded sequences.	15min
Phase 4: Application & Discussion	Real-world uses; peer activity on convergence.	10min
Phase 5: Assessment & Recap	Quiz and mind map summary.	5min

1.Topics for Learning Through Evocation:

- Introduce examples like population growth, bacterial growth, or depreciation of value, which can be modelled by sequences.
- Ask students to think about patterns they notice in daily life, such as the sequence of days, months, or repeated events (e.g., traffic lights changing colours).

2.Topic Introduction:

2.1: General Objectives:

- Introduce the concept of sequences and convergence in real numbers.
- Develop an understanding of sub sequences and Cauchy sequences.

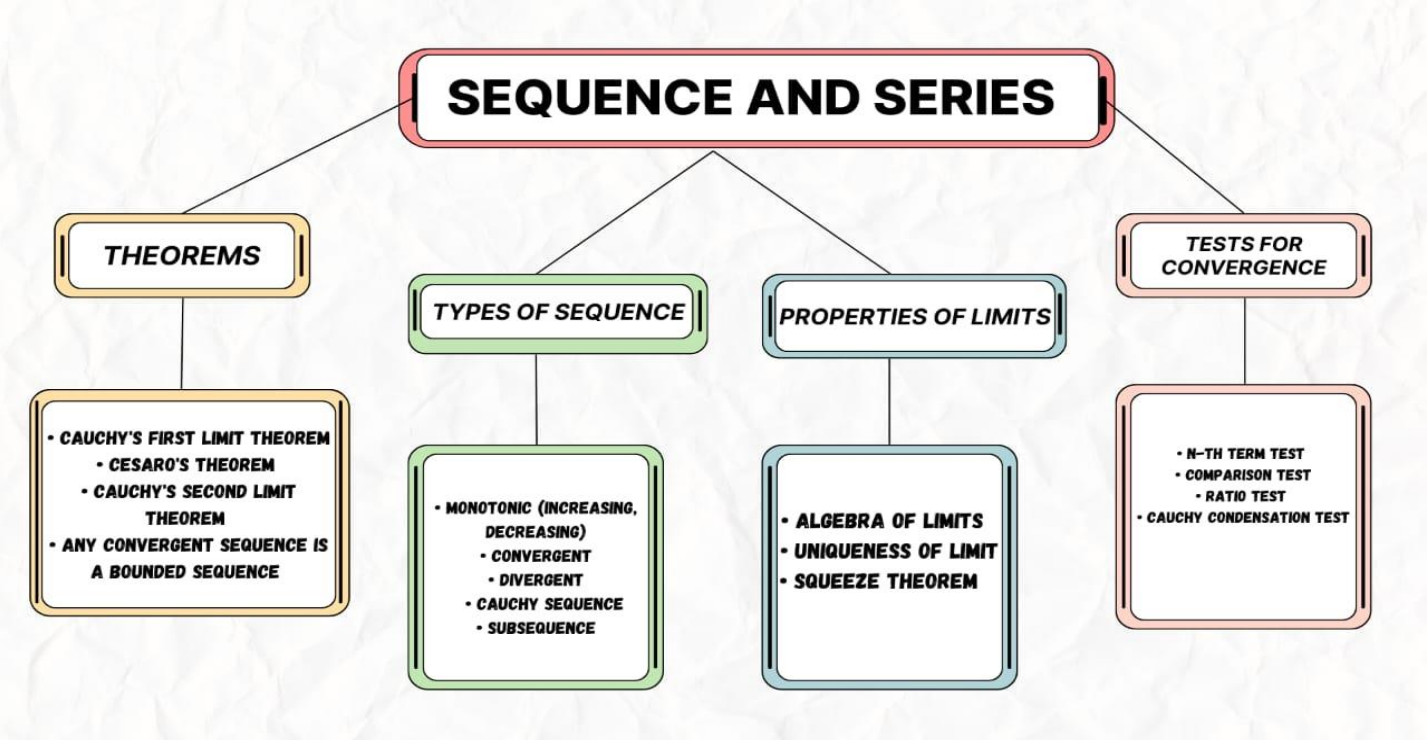
2.2: Specific Outcomes:

- SO1: Define and classify types of sequences.
- SO2: Analyse convergence/divergence using limits.
- SO3: Apply theorems to test monotonicity and boundedness.

2.3: Discussion & Student Engagement:

- Think-Pair-Share activity on determining convergence.
- Group work: Identify monotonic sequences from given sets.

Mind Map:



Summary:

A sequence is an ordered list of numbers that follow a certain rule. It can be finite or go on forever (infinite). Some sequences increase, some decrease, and some change in different ways. If the numbers in a sequence get closer to a fixed value, it is called a convergent sequence. If they don't settle on any value, the sequence is divergent. Sequences can be used in real life, like in population growth, savings, or computer programs.

2.4: Taxonomy of Objectives:

Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1	2				
B. Conceptual Knowledge		1	2			

C. Procedural Knowledge			2	1		
D. Meta Cognitive Knowledge					1	

2.5: Key words:

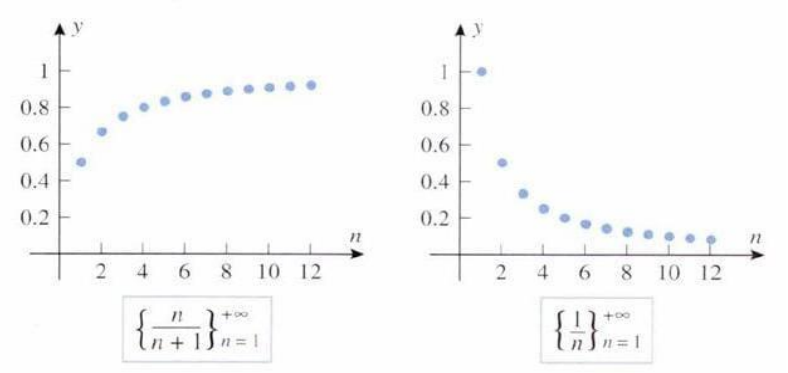
- Sequence
- Convergence
- Limit
- Bounded
- Monotonic
- Divergence

2.6: Key Diagrams:

Monotone Sequences

$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \ldots, \frac{n}{n+1}, \ldots$ Strictly increasing

$1, \frac{1}{2}, \frac{1}{3}, \ldots, \frac{1}{n}, \ldots$ Strictly decreasing



PowerpointPresentation:

https://docs.google.com/presentation/d/1NLsDbqpj686nnsDwUPd06ofnXmcCHYdf/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

3. Assessment through Questions/Analogy/New Ideas:

- FA1: Extract a convergent subsequence from a divergent sequence.
- FA2:Prove a sequence is monotonic and bounded.

4. FAQs & Discussion Questions:

1. What is the difference between a bounded and convergent sequence?
2. Can a divergent sequence be bounded?
3. How do monotonicity and boundedness ensure convergence?
4. What is the limit of the sequence $a_n = 1/n$?

5. References:

1. Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis (Fourth edition), Wiley Publication, 2017
2. Dr. Arumugam.S&ThangapandiIssac.A, Sequences and Series and Trigonometry, New Gamma Publishing House, Palayamkottai (June 2014).
3. J.A. Green, Sequences and Series, Routledge& Kegan Paul Ltd, 1958

6. Verified by Subject Expert:

Dr. Sr. S. Kulandai Therese

Approved by HoD

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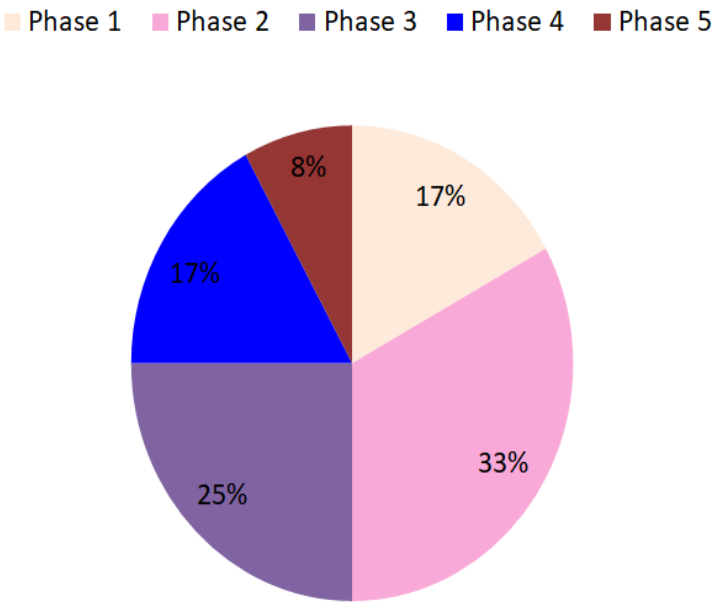
Lesson Plan

Programme	B. Sc Mathematics
Semester	III
Course Title	Allied – Statistics I
Code	21UMMA31
Hours	6
Total Hours	90
Credits	4
Max Marks	100
Unit & Title	Unit I: Moments in Statistics
Name of the Faculty	Dr. V.L. Stella Arputha Mary
T-L tools	Mind Maps, Video, Art Project, Think-Pair-Share

Pre-requisite Knowledge

- Understanding of mean , standard deviation and variance
- Introduction to probability distribution

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Definition and purpose of moments in statistics	10 min
Phase 2: Computation	Calculation of raw and central moments (1^{st} to 4^{th} order)	20 min
Phase 3: Interpretation	Expalnation of skewness and kurtosis using moments	15 min
Phase 4: Application	Use of moments in comapring distribution	10 min
Phase 5: Assessment	Quick quiz and summary of key points	5min

1.Topics for Learning Through Evocation

- Discuss real-life examples where data distribution shape matters (e.g., stock prices, income distribution).
- Ask students if they've ever encountered symmetrical/asymmetrical data in practice.

2.Topic Introduction

2.1: General Objectives:

- To introduce the concept and utility of moments in statistical analysis
- To understand how moments describe shape characteristics of data

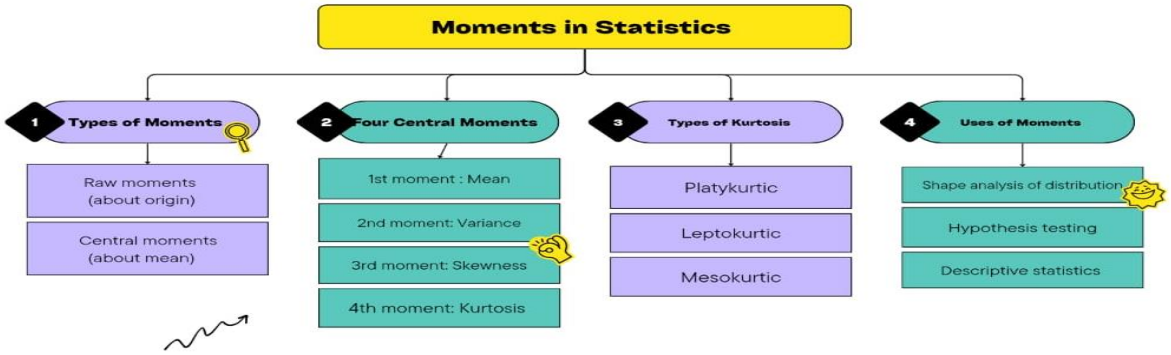
2.2: Specific Outcomes:

- **SO1**: Define and interpret the concepts of moments in statistics
- **SO2**:Calculate the first four moments (mean, variance, skewness and kurtosis)
- **SO3:** Understand the significance of skewness and kurtosis in data analysis

2.3: Discussion & Student Engagement

- Use datasets to plot distributions and visualize skewness and peakedness
- Group activity to calculate and compare moments of two different datasets

Mind Map



Summary

Moments summarize the shape characteristics of data distributions.

The first moment is the mean, the second measures spread, the third shows skewness, and the fourth indicates kurtosis.

Higher-order moments help compare datasets in more nuanced ways.

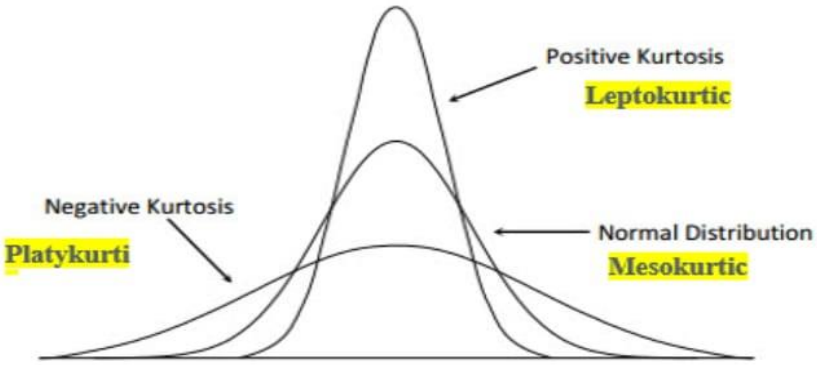
2.4: Taxonomy of Objectives

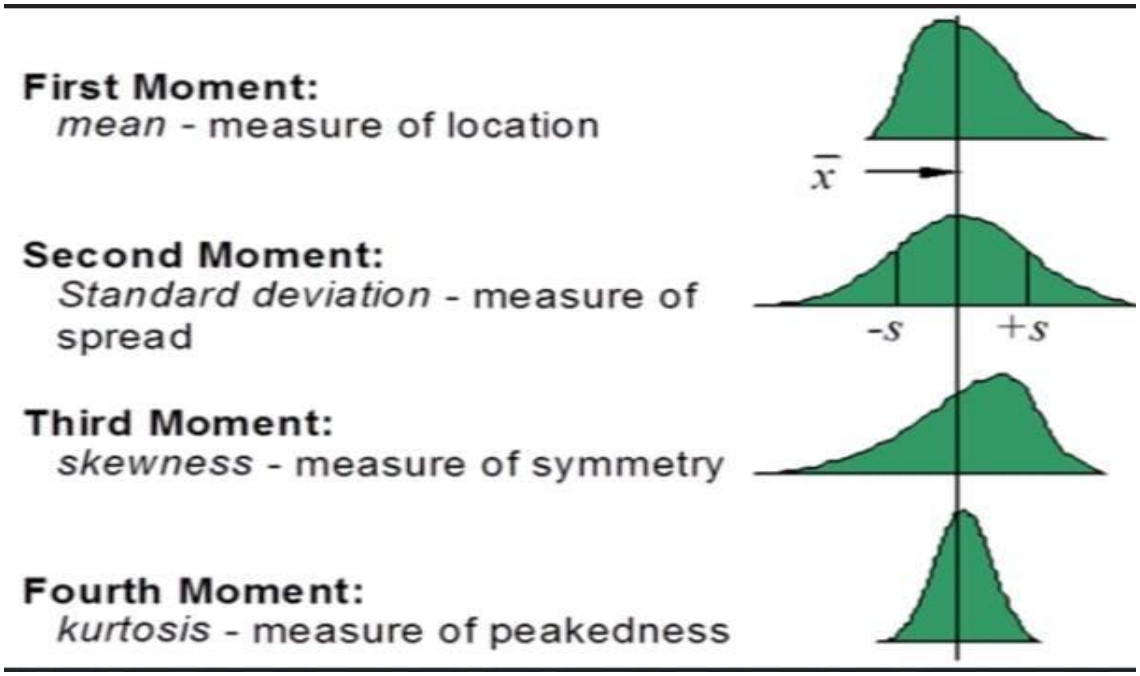
Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		1,2	3			
C. Procedural Knowledge			3	3		
D. Meta Cognitive Knowledge						

3.Key Terms:

- Moments
- Central Moment
- Raw Moment
- Skewness
- Kurtosis
- Symmetrical/Asymmetrical Distribution

4.Key Diagrams: (if any)





Powerpoint Presentation

https://docs.google.com/presentation/d/1J5cEIY-khwgXXe1-KKLUAGIrPv3KCmHT/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

5.Assessment Through Questions/Analogy/New Ideas:

- **FA1:** Calculate 2^{nd} and 3^{rd} moments for a given dataset
- **FA2:** Interpret skewness and kurtosis from computed moments

6.FAQs& Discussion Questions:

1. What is the significance of the second moment about the mean?
2. How do moments help us understand the shape of a distribution?
3. What does positive skewness indicate?
4. Can two datasets have the same mean and variance but different skewness?

7.References:

1. S.Arumugam and A.Issac, Statistics, New Gamma publishing House. Palayamkottai
2. Gupta S.C., Kapoor V.K., Fundamentals of mathematical Statistics Eleventh edition, Sultan Chand & Sons, Educational Publishers, New Delhi.
3. H.C.Saxena, Elementary Statistics, S.Chand& Company Ltd., New Delhi

8. Verified by subject Expert:

Course In-charge

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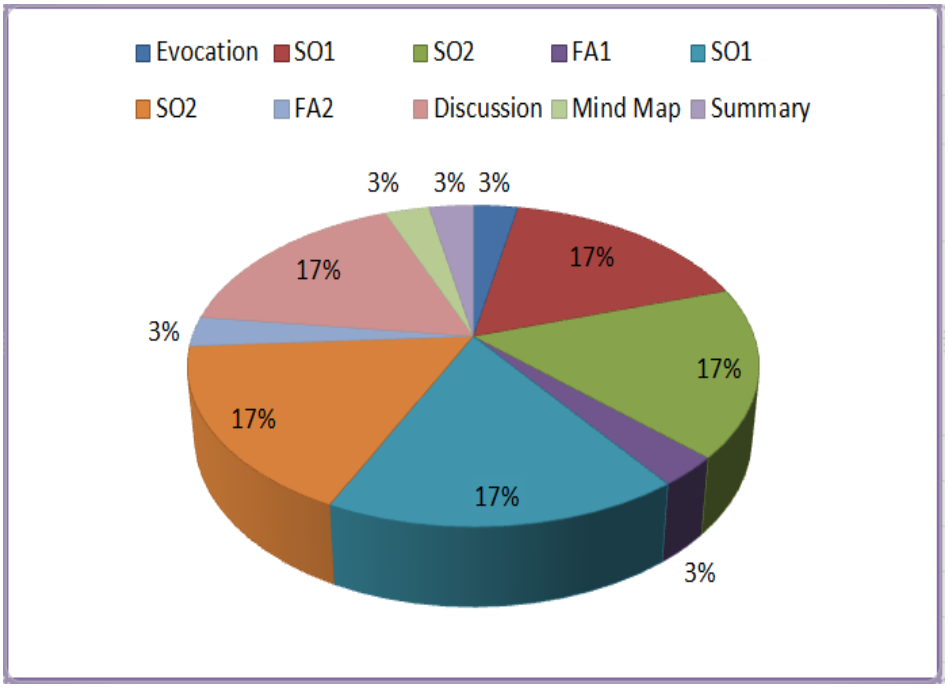
Lesson Plan

Programme	B. Sc Mathematics
Semester	III
Course Title	Introduction to Python Programming
Code	21UMAS31
Hours	2
Total Hours	30
Credits	2
Max Marks	50
Unit & Title	Unit IV: Strings
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Map, Art Project, Think-Pair-Share

Pre-requisite Knowledge:

Basic understanding of programming concepts, familiarity with Python syntax, and fundamental knowledge of data types.

Micro-Planning (60 minutes)



1. Topics for Learning through Evocation:

Briefly introduce strings in Python and their significance in programming. Ask students how they have encountered text-based data in everyday applications.

2. Topic Introduction:

2.1 General Objective:

- To understand the properties and operations of strings in Python.
- To learn various string manipulation techniques used in programming.

2.2 Specific Outcomes:

- Understand string declaration, indexing, and slicing.
- Implement basic string operations and methods.

First Phase:

- **SO1 (10 minutes):** Introduction to string data type, indexing, slicing, and string literals.
- **SO2 (10 minutes):** Hands-on demonstration of basic string operations (concatenation, repetition, length, membership testing).

Second Phase:

- **SO1 (10 minutes):** Introduction to built-in string functions (upper (), lower (), strip (), replace (), split ()).
- **SO2 (10 minutes):** Writing simple programs using string methods and formatting.

MindMap(2minutes):
Create a simple mind map illustrating key elements of Python strings (e.g., indexing, slicing, methods, formatting)

Summary(2minutes):
Summarize the lesson by emphasizing the importance of strings, their operations, and built-in functions.

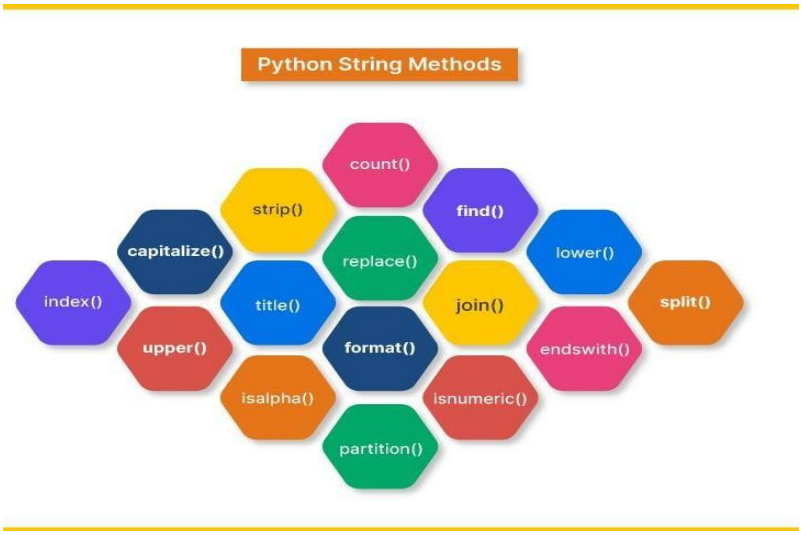
2.3 Taxonomy of Objectives:

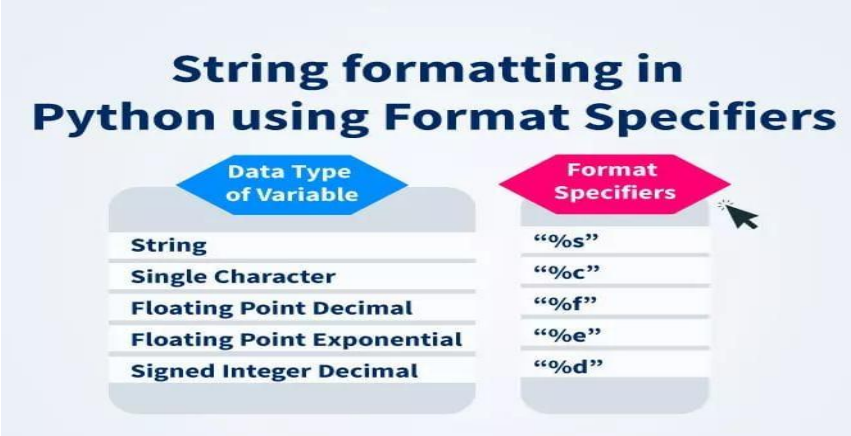
Knowledge Dimension	**The Cognitive Process Dimension**
Factual Knowledge	Remember, Understand
Conceptual Knowledge	Apply, Analyse
Procedural Knowledge	Evaluate, Create
Meta-Cognitive Knowledge	-

2.4 Key Words:

- Strings
- Indexing
- Slicing
- Concatenation
- String Methods
- Formatting

2.5: Key Diagrams :





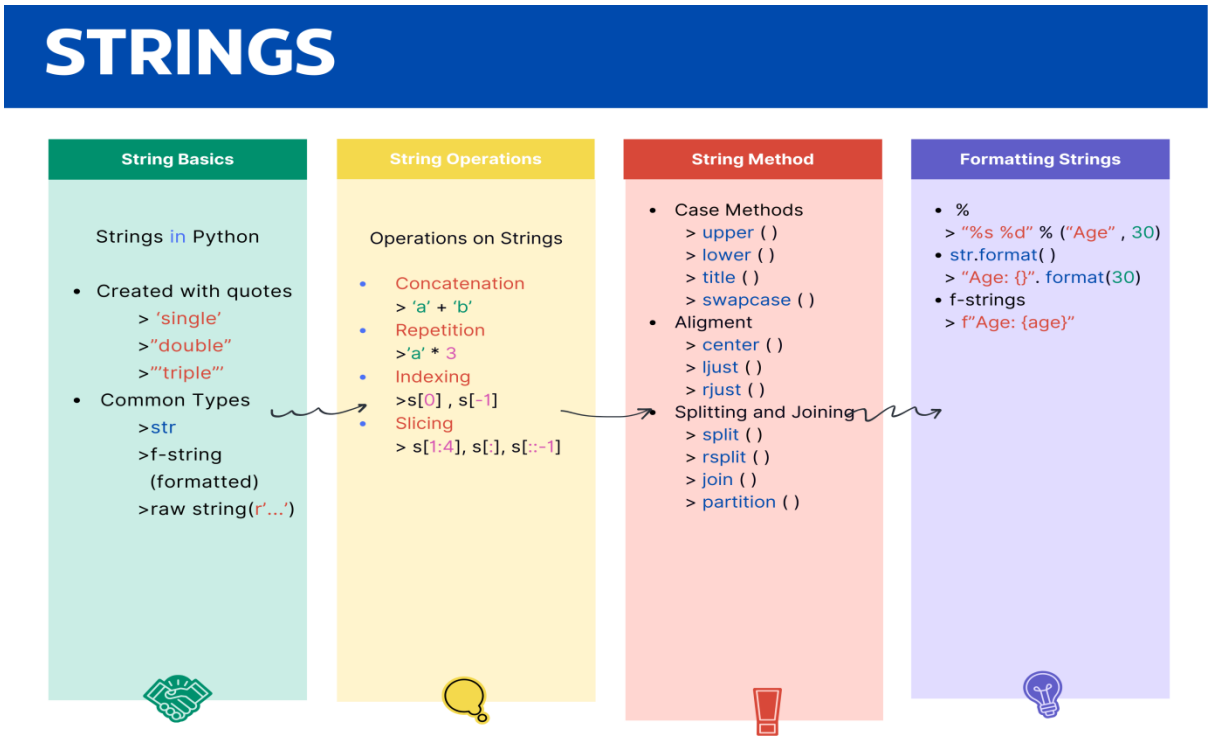
Powerpoint Presentation

https://docs.google.com/presentation/d/1-1i-s-RKcGoNkAf3zVLtPNaSx3fkIWGq/edit?usp=drive_link&ouid=115291083755644247696&rtpof=true&sd=true

3. Discussion:

- How are strings stored and manipulated in Python?
- What are some real-world applications of string operations?
- How do different string methods improve text processing?

4. Mind Map:



5. Summary:

Strings in Python are immutable sequences of characters. Various methods and operations can be used to manipulate and format them efficiently. Understanding these operations is essential for text-based data processing.

6. Assessment through Questions/Exercises:

- **FA1 (2 minutes):** Define a string and perform slicing on it.
- **FA2 (2 minutes):** Write a Python script that takes user input, manipulates the string, and prints the modified result.

7. FAQ's: MCQs/ Descriptive Questions:

1. What is the difference between indexing and slicing in strings?
2. How does Python handle string immutability?
3. Write a Python program to count the number of vowels in a given string.

8. References:

- Mark Lutz, *Learning Python*, O'Reilly Media, 2013.
- Zed A. Shaw, *Learn Python the Hard Way*, Addison-Wesley, 2014.
- Official Python Documentation: https://docs.python.org/3/

9. Verified by Subject Expert:

G Priscilla Pacifica.

Course In-Charge

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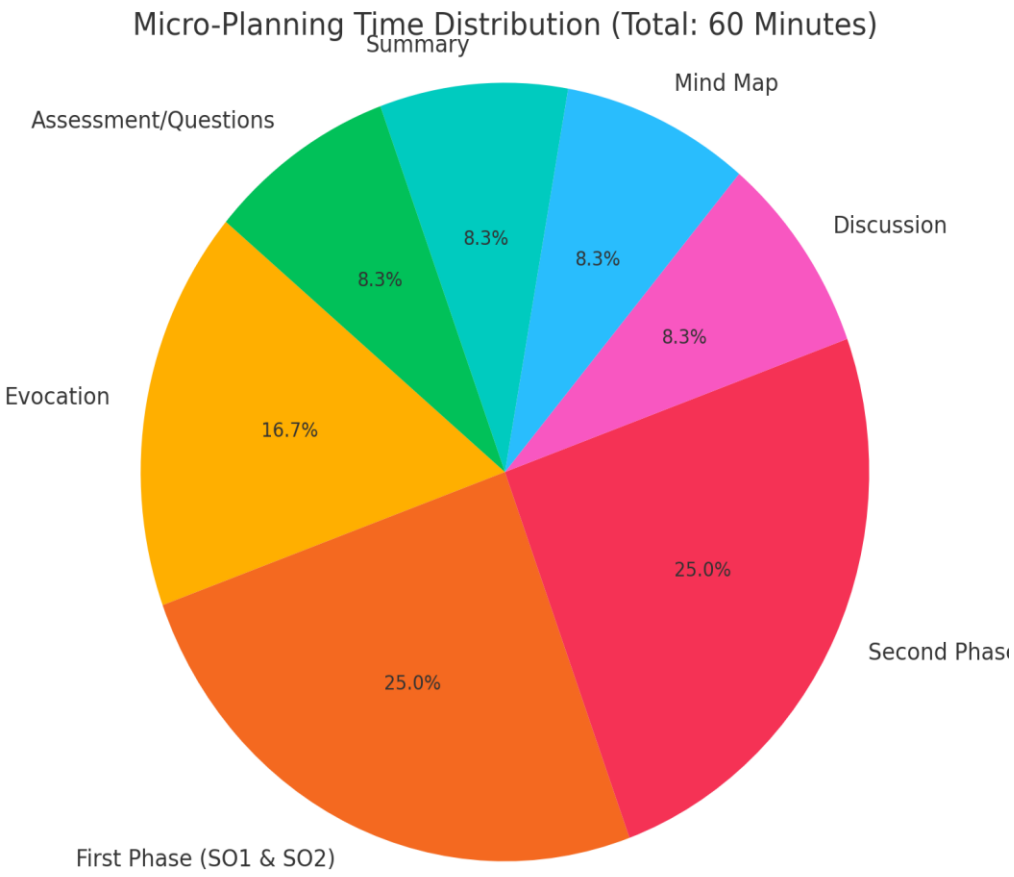
Lesson Plan

Programme	BA, B.com, B.sc
Semester	III
Course Title	NME I - Mathematics for Competitive Examinations
Code	21UMAN31
Hours	2
Total Hours	30
Credits	2
Max Marks	75
Unit &Title	Unit II Simplification
Name of the Faculty	Dr.J.Arul Jesti
T- L tools	Whiteboard & markers, Problem-solving worksheets, Interactive quizzes

Pre-requisite Knowledge

- Basic arithmetic operations (addition, subtraction, multiplication, division)
- Knowledge of algebraic terms and operations
- Understanding of brackets and the order of operations (BODMAS)

Micro- Planning:(60Minutes)



Topics for Learning through Evocation (10 Min)

- Daily Life Math
- Mental Math Challenge

General Objective

- To develop students' skills in simplifying numerical and algebraic expressions using standard mathematical rules.

Specific Outcomes

- **SO1**: Apply BODMAS to simplify numerical expressions.
- **SO2**: Combine like terms in algebraic expressions.
- **SO3**: Apply the distributive property to simplify expressions with brackets.
- **SO4**: Solve simplification problems involving integers and fractions.

First Phase (SO1 & SO2)

- Teach and practice applying BODMAS rules.
- Class activity: Simplify expressions like $8 + 2 \times (3 + 4) \div 2$.

Second Phase (SO1 & SO2)

- **SO2**: Identify and combine like terms (e.g., $3x + 5x - 2$).
- **SO3**: Apply distributive law: $2(x + 3) = 2x + 6$.
- FA2: Short quiz: 3–5 questions mixing numerical and algebraic simplification.

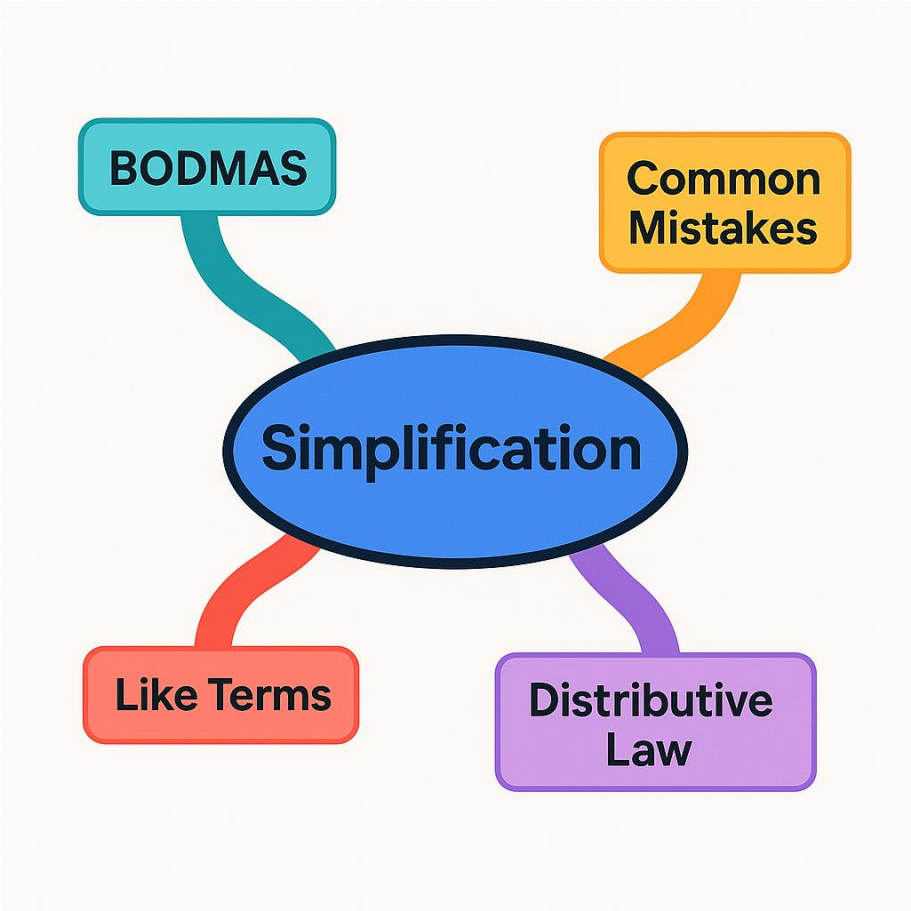
Discussion Topics (5Min)

- Why simplification is important in solving equations.
- Common mistakes in simplification (e.g., incorrect handling of signs).

Mind Map (5Min)

Central Node: **Simplification**

- Branch 1: BODMAS
- Branch 2: Like Terms
- Branch 3: Distributive Law
- Branch 4: Common Mistakes



Summary (5Min)

- Emphasize BODMAS and like terms.
- Reinforce the use of brackets and distributive law.

Assessment through Questions & New Ideas:

Simplify:

1.5 + 2 × (6 – 3)

2.4x + 3 – 2x + 7

3.(2x – 5) + 4(x + 1)

FAQs (MCQs &Descriptive)

1. Explain the BODMAS rule with an example.

2. Simplify the following expression and show your steps:
4x – 3 + 2x + 7 – (x – 2)

3.Why is simplification important in solving mathematical problems?

4. Use the distributive law to expand and simplify: $2(x + 3) + 3(2x – 1)$.

References

1. Aggarwal R.S., Arithmetic Subjective and Objective for Competitive Examinations.
2. Abhijit Guha, Quantitative Aptitude for Competitive Examinations.

Verified by Subject Expert:

Course In-Charge
J. Arul Jesti

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Lesson Plan

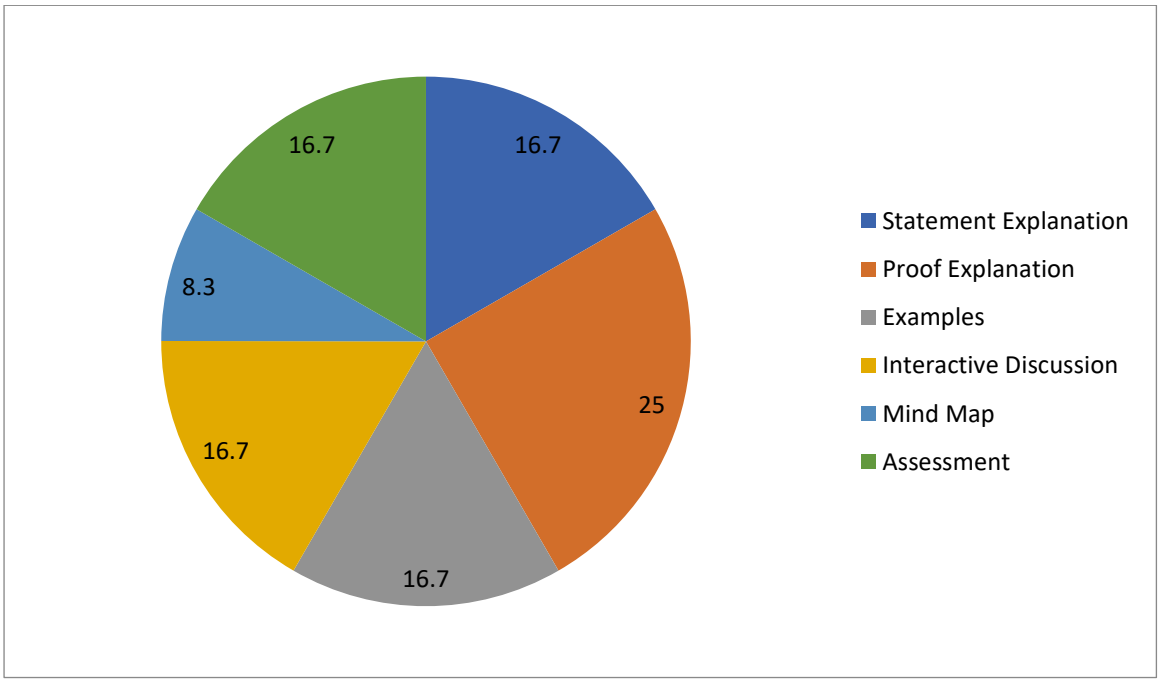
Programme	B. Sc Mathematics
Semester	V
Course Title	Modern Algebra
Code	21UMAC41
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit II : Lagrange's Theorem
Name of the Faculty	Dr.Sr.S. Kulandai Therese
T-L tools	Mind Maps, Project, Assignments, PPT

1. Pre-requisite Knowledge:

Basic understanding of

- Basic set theory and number theory.
- Definitions and examples of groups and subgroups.
- Understanding of group order and element order

2. Micro-Planning: (120 minutes)



3. Topics for Learning through Evocation

Understanding the relationship between the order of a group and the order of its subgroups through **Lagrange's Theorem**, which is foundational in abstract algebra.

Topic Introduction:

This lesson introduces **Lagrange's Theorem**, a key result in group theory. It provides insight into the divisibility of group orders and has important implications in solving group-related problems in algebra and cryptography.

4. General Objective:

To understand and apply **Lagrange's Theorem** in finite group theory.Specific Outcomes:

5. Specific Objectives:

By the end of this lesson, students will be able to:

1. State and explain Lagrange's Theorem.
2. Prove Lagrange's Theorem for finite groups.
3. Determine the possible orders of subgroups.

6. Taxonomy of Objectives

Taxonomy of Objectives						
Knowledge Dimension	**TheCognitiveProcess Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
A.FactualKnowledge	1	2				
B.Conceptual Knowledge		2	3			
C.Procedural Knowledge			3			
D.Meta-Cognitive Knowledge						

Keywords:

Group, Subgroup, Coset, Order, Index, Lagrange's Theorem, Fermat's Theorem, Prime Order, Symmetry

7. Key Diagrams:

- Visual representation of cosets.
- Group tables highlighting subgroup patterns.
- Flowchart of proof structure.

8. Discussion Topics:

- Why the order of a subgroup divides the order of a group.
- Real-world implications in cryptography and number theory.
- When the converse of Lagrange's Theorem does or does not hold.

Power Point Presentation

9. Mind Map

- Lagrange's Theorem
  - Cosets
  - Proof
  - Examples
  - Applications
  - Limitations
  - Connections (e.g., Fermat's Little Theorem)

10. Summary

Students will understand Lagrange's Theorem, its proof, and its applications. The theorem's utility in analyzing subgroup structure and problem-solving in algebra will be emphasized.

11. Assessment Through Questions & New Ideas:

- **Formative:** Think-pair-share on coset examples, mini-quizzes

- **Summative:** Assignment with problems using Lagrange's Theorem, including proofs and counterexamples

12. FAQs (MCQs & Descriptive Questions):

- What does Lagrange's Theorem state?

- How is the index of a subgroup related to its order?

- Can any divisor of the group order be the order of a subgroup?

- Does Lagrange's Theorem apply to infinite groups?

Powerpoint Presentation

https://app.presentations.ai/view/8bQAI0

References:

- Joseph A. Gallian, *Contemporary Abstract Algebra*
- John B. Fraleigh, *A First Course in Abstract Algebra*
- Online lecture notes and videos on group theory

Verified by Subject Expert:

Dr. Sr. S. Kulandai Therese

Approved by HoD

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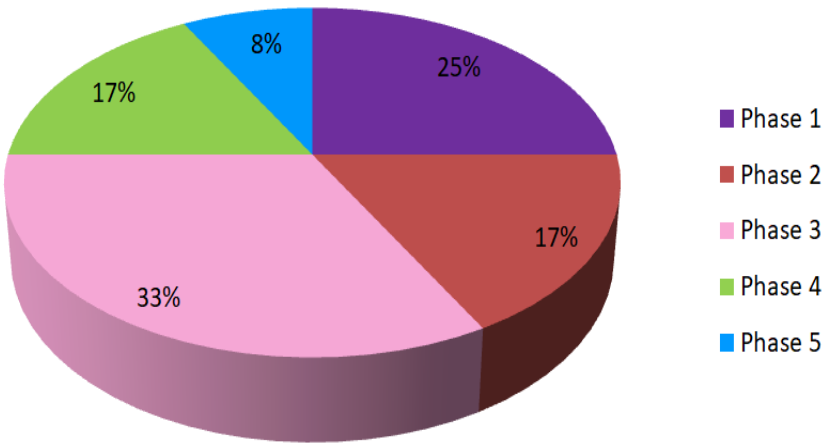
Lesson Plan

Programme	B. Sc Mathematics
Semester	IV
Course Title	Allied – Statistics II
Code	21UMMA41
Hours	6
Total Hours	90
Credits	4
Max Marks	100
Unit & Title	Unit II: Statistical Quality Control
Name of the Faculty	Dr. V.L. Stella Arputha Mary
T-L tools	Mind Maps, Video, Art Project, Think-Pair-Share

Pre-requisite Knowledge

- Understanding of mean, variance and standard deviation
- Concepts of variability and normal distribution
- Familiarity with sampling and process data

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Overview of Quality Control and its importance	15 min
Phase 2: Control Charts	Concepts of $\bar{X}$, R and s charts; interpretation	10 min
Phase 3: AttributesCharts	np, p, c and u charts	20 min
Phase 4: Applications	Case studies from manufacturing and services	10 min
Phase 5: Assessment & Recap	Quick quiz and summary of key points	5min

1.Topics for Learning Through Evocation

- Discuss examples from industries like automotive, food processing, or pharmaceuticals.
- Encourage students to identify defects in real-life products and consider how they might be controlled statistically.

2.Topic Introduction

2.1: General Objectives:

- Introduce the concept and types of control charts.
- Understand the role of SQC in maintaining product/service standards.

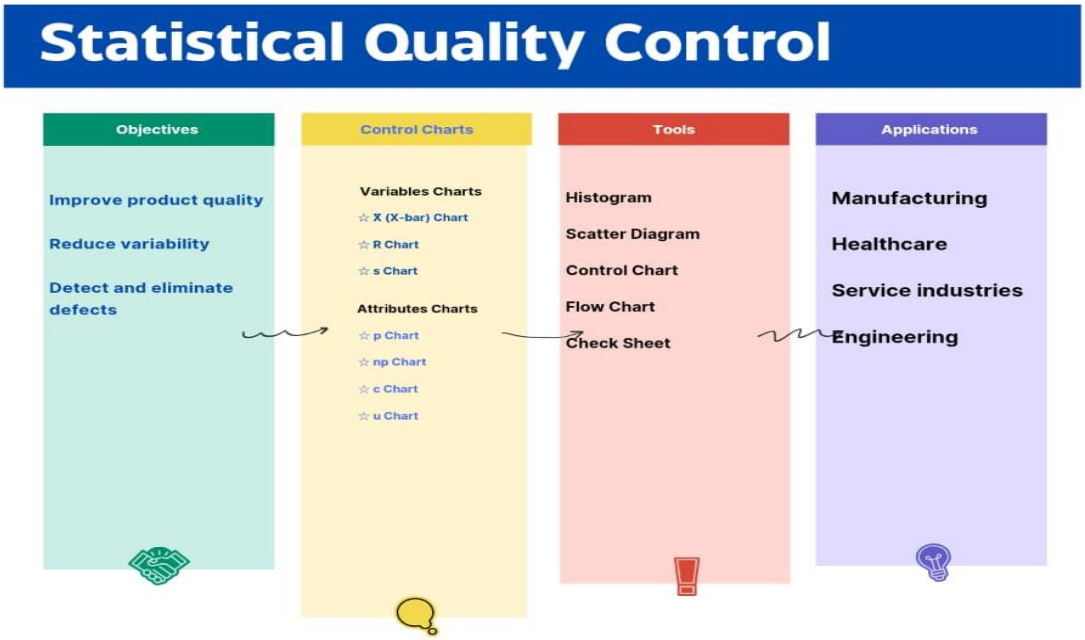
2.2: Specific Outcomes:

- **SO1**: Describe the components and purpose of control charts.
- **SO2**: Construct and interpret $\bar{X}$ and R charts for variables.
- **SO3**: Analyze attribute data using p, np, c, and u charts.

2.3: Discussion & Student Engagement:

- Real-world examples (e.g., quality check in bottling plant).
- Group task: Interpret a control chart and decide if the process is in control.

Mind Map



Summary

Statistical Quality Control is key in monitoring production processes using data. Control charts help identify variability due to assignable or common causes. Charts differ for variables and attributes and must be applied appropriately to maintain consistent quality.

2.4: Taxonomy of Objectives

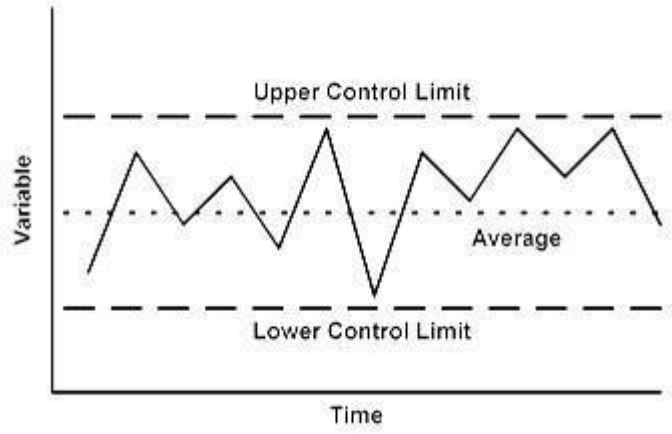
Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1,2	1				
B. Conceptual Knowledge		1,2	3			
C. Procedural Knowledge				3		

D. Meta Cognitive Knowledge						

3.Key Terms:

- Statistical Quality Control (SQC)
- Control Charts
- $\bar{X}$ chart, R chart, s chart
- p chart, np chart, c chart, u chart
- Process variability
- Control limits

4.Key Diagrams: (if any)



Powerpoint Presentation

https://docs.google.com/presentation/d/1KQnnxzXCZ6LHGC9YgRpo6mUTKeK2-GiP/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

5.Assessment Through Questions/Analogy/New Ideas:

- **FA1:** Construct an $\bar{X}$ and R chart from sample data.
- **FA2:** Interpret a p-chart and assess process control.

6.FAQs & Discussion Questions:

1. When should we use an attribute chart over a variable chart?
2. What does it mean if a point lies outside control limits?
3. Why use both $\bar{X}$ and R charts instead of just one?

4. How do you determine if a process is stable?

7.References:

1. Gupta S.P., Statistical Method, forty fourth editionSultan chand & sons publishers-New Delhi.
2. Arumugam S. and Issac A., Statistics, New Gamma publishing House. Palayamkottai.
3. Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics , Eleventh edition, Sultan Chand & Sons, Educational Publishers, New Delhi.

8. Verified by subject Expert:

Course In-charge

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Approved by HoD

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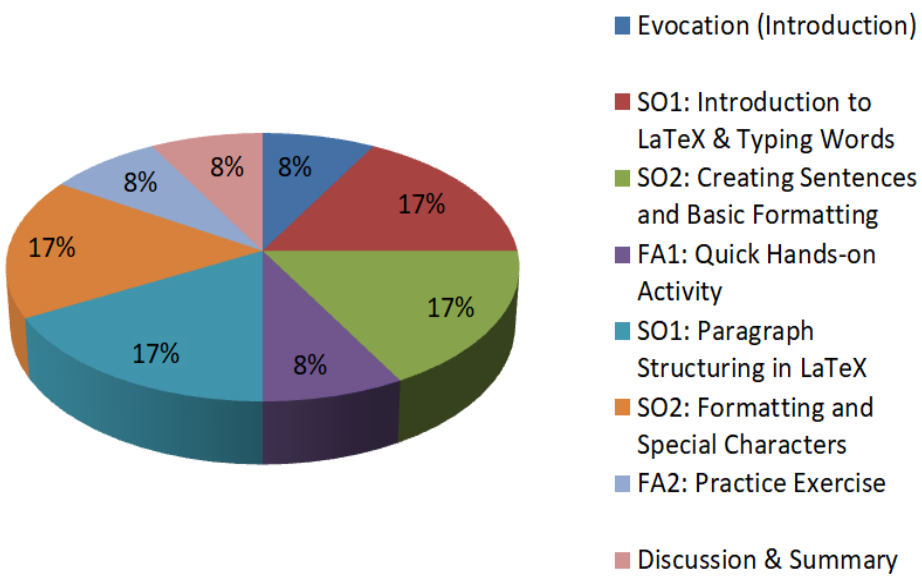
Lesson Plan

Programme	B. Sc Mathematics
Semester	IV
Course Title	Documentation Using Latex
Code	21UMAS41
Hours	2
Total Hours	30
Credits	2
Max Marks	50
Unit & Title	Unit I: Typing Text: Words, Sentences and Paragraphs
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Maps, Art Project, Think-Pair-Share

Pre-requisite Knowledge

- Basic understanding of text editors
- Familiarity with document formatting in word processors
- Fundamental knowledge of mathematical notation

Micro-Planning (60 minutes per session)



1. Topics for Learning Through Evocation (5 min)

- Discuss common problems in document formatting using traditional word processors.
- Introduce LaTeX as a powerful tool for document preparation.
- Showcase examples of professional documents created using LaTeX.

2. Topic Introduction

General Objective:

- To introduce students to LaTeX and its basic commands for text formatting.

Specific Outcomes (SOs):

- **SO1:** Learn the syntax for typing words and simple text in LaTeX.
- **SO2:** Apply sentence and paragraph structuring with formatting options.

2.1: First Phase: Understanding Basic Text Typing in LaTeX

- **SO1 (15 min):**
    - Introduction to LaTeX syntax (\document class{article}, \begin{document}, \end{document}).
    - Typing words and simple text (\text bf {}, \text it {}, \under line {} for formatting).
    - Differences between normal text entry in LaTeX and word processors.
- **SO2 (15 min):**
    - Creating sentences in LaTeX and understanding spacing.
    - Using special characters (\, {}, $, %, &, #, _).
    - Applying bold, italic, and underlining to text.
- **FA1 (5 min) - Hands-on Activity:**
    - Students will type and compile a simple LaTeX document containing a few formatted words and sentences.

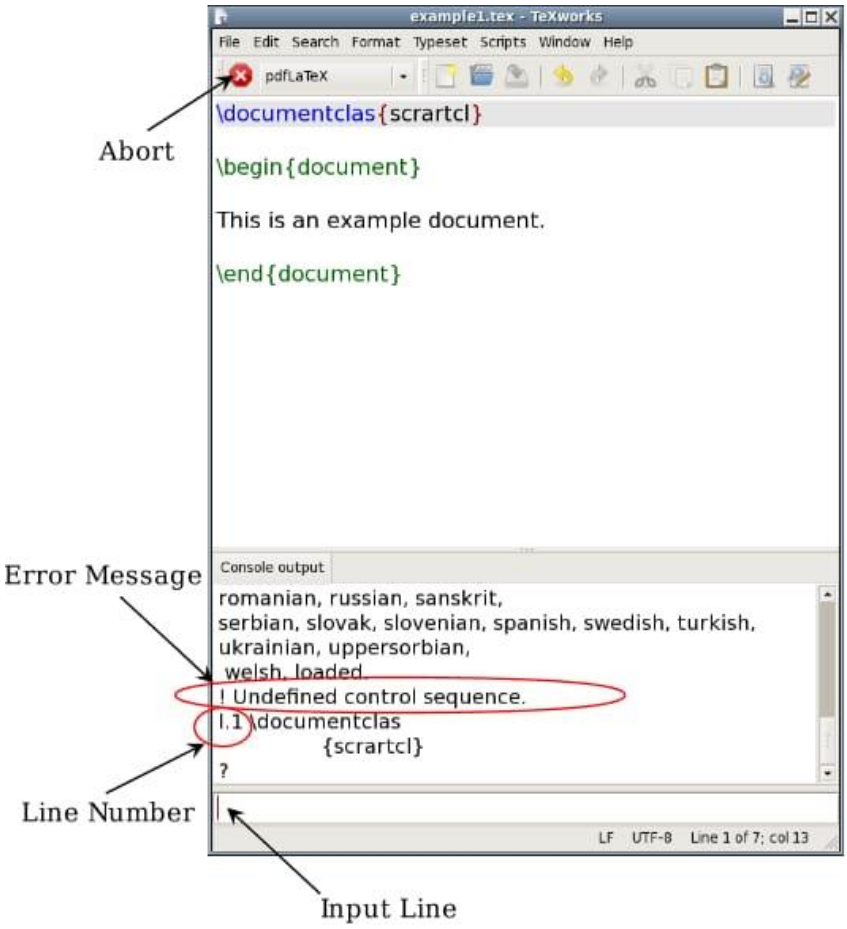
2.2: Second Phase: Paragraph Structuring & Formatting in LaTeX

- **SO1 (15 min):**
    - Creating paragraphs in LaTeX and handling line breaks (\\, \par).

- Adjusting paragraph spacing with commands like \set length{\par indent} and \set length{\parskip}.

- **SO2 (10 min):**
  - Adjusting alignment (left, center, right, justify).
  - Using \texttt{} for typewriter-style text.
  - Adding comments using %.
- **FA2 (5 min) - Practice Exercise:**
  - Students will format a paragraph using alignment and spacing commands.

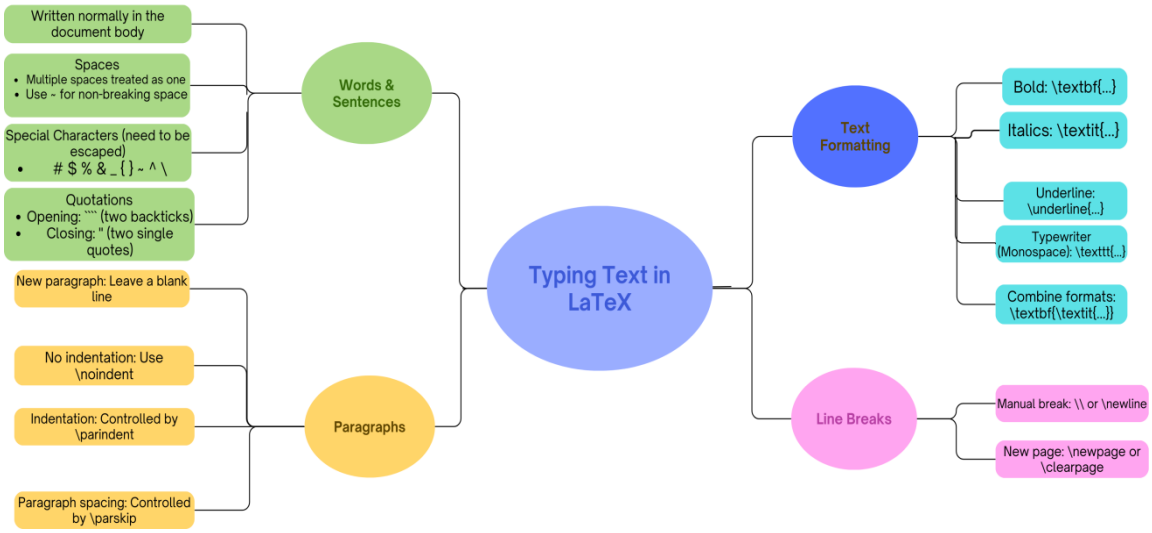
3. Key Diagrams



Powerpoint Presentation

https://docs.google.com/presentation/d/1MS9oROeuHKDylNpzBRrlxIi5PfuO2vDv/edit?usp=sharing&ouid=115291083755644247696&rtpof=true&sd=true

Mind Map:



4. Discussion & Summary (5 min)

- Recap of LaTeX basics for text typing and formatting.
- How LaTeX differs from word processors in text handling.
- Q&A session for clarifying doubts.

5. Taxonomy of Objectives

Knowledge Dimension	**The Cognitive Process Dimension**
A. Factual Knowledge	Remember, Understand
B. Conceptual Knowledge	Apply, Analyze
C. Procedural Knowledge	Evaluate, Create

6. Key Terms & Concepts

- LaTeX document structure
- Text formatting commands
- Special characters in LaTeX
- Paragraph and sentence structuring

7. Assessment Through Questions/Activities

Formative Assessment 1 (FA1):

- Type a sentence in LaTeX using different formatting styles (bold, italics, underlined).

Formative Assessment 2 (FA2):

- Format a given paragraph using proper spacing, alignment, and special characters.

8. Discussion Questions:

1. How does LaTeX handle text differently from word processors?
2. What are the benefits of using LaTeX for document formatting?
3. How can we include special characters in LaTeX?

9. References

1. Lamport, Leslie. *LaTeX: A Document Preparation System*. Addison-Wesley, 1994.
2. Mittelbach, Frank, et al. *The LaTeX Companion*. Pearson Education, 2004.
3. Overleaf Documentation: https://www.overleaf.com/learn

10. Verified by Subject Expert

Course In-charge

G. Priscilla Pacifica

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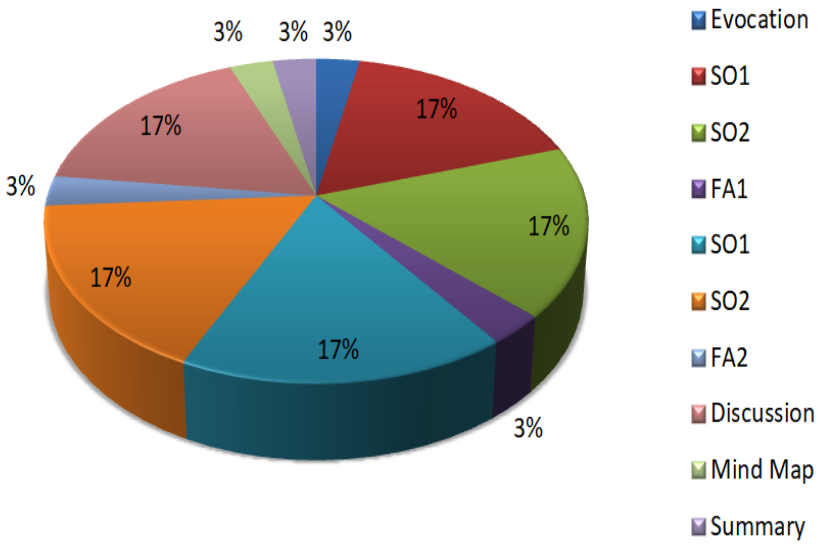
Lesson Plan

Programme	B. Sc Mathematics
Semester	IV
Course Title	Mathematics for Competitive Examination II
Code	21UMAN41
Hours	2
Total Hours	30
Credits	2
Max Marks	50
Unit & Title	Unit IV: Simple Interest
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Maps, Art Project, Think-Pair-Share

Pre-requisite Knowledge

- Basic understanding of arithmetic operations and familiarity with savings, loans, and borrowing.
- Familiarity with percentages and decimals.

Micro-Planning Scheme (60 minutes per session)



1.Topics for Learning Through Evocation:

- Discuss real-life situations where people borrow or save money (e.g., bank loans, savings accounts) to highlight the concept of earning or paying extra money interest.

2.Topic Introduction:

2.1: General Objectives:

- To build a clear conceptual understanding of what interest is, why it's charged or earned, and how it affects financial transactions.
- To enable students to accurately apply the Simple Interest formula in a variety of real-world contexts.

2.2: Specific Outcomes:

First Phase:

- SO1(10 minutes): Define and understand the formula for Simple Interest.
- SO2(10 minutes): Identify the variables: Principal (P), Rate (R), Time (T), and Interest (I).

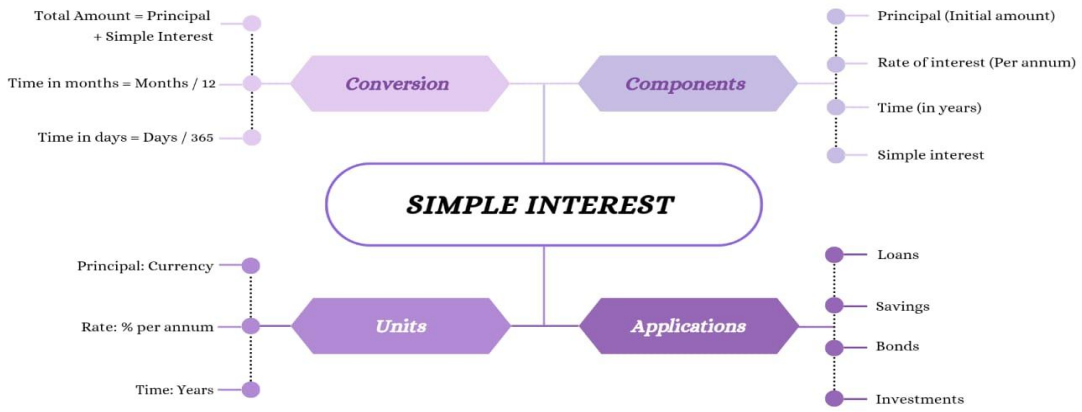
Second Phase:

- SO1(10 minutes)**:** Calculate simple interest using the formula**.**
- SO2(10 minutes): Solve real-life problems involving simple interest.

2.3: Discussion & Student Engagement (10 minutes):

- Facilitate a conversation on why interest is important in daily life.
- Think-Pair-Share Activity: Ask students to share any personal or family experiences with banks, loans, or savings.

Mind Map (2 minutes)



Summary (2 minutes)

Recap key points: Definition, formula, and applications of simple interest.

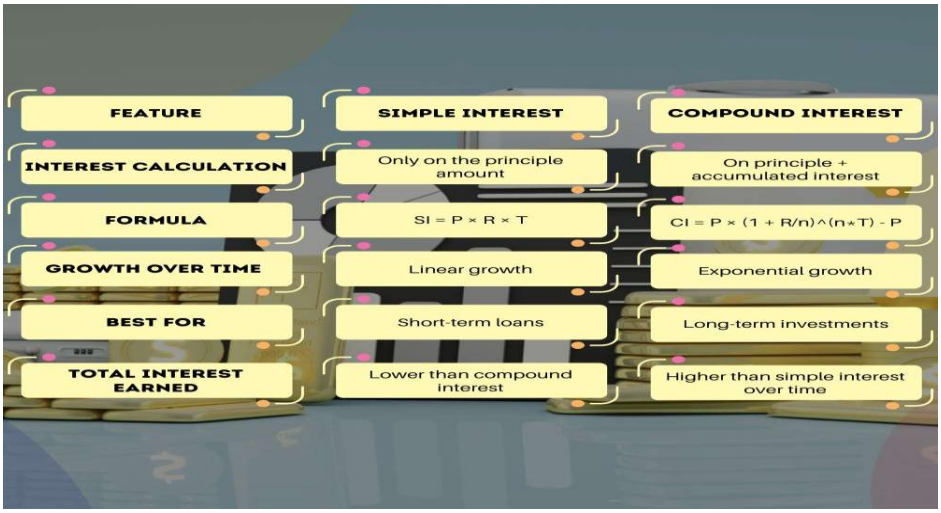
2.4: Taxonomy of Objectives:

Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge						
B. Conceptual Knowledge						
C. Procedural Knowledge						
D. Meta Cognitive Knowledge						

2.5: Key words:

- Principal (P)
- Rate of Interest (R)
- Time (T)
- Simple Interest (SI)
- Formula: SI = (P × R × T)/100

2.6: Key Diagrams (if any)



Powerpoint Presentation

https://docs.google.com/presentation/d/1IhR7DG7IrnvEdCX1douCynzpTePF16oZ/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

3. Assessment Through Questions/Analogy/New Ideas:

- FA1(2 minutes): What happens to the interest if the time is doubled?
- FA2(2 minutes): Give two different simple interest situations and compare which one earns or pays more interest and why.

4. FAQs & Discussion Questions:

1. Why is it important to understand interest?
2. What is the difference between principal and interest?
3. How does time or rate affect the amount of interest?
4. Why is it important to know how to calculate interest before taking a loan?

5. References:

1. Aggarwal R.S., Objective Arithmetic (Edition 2004), S.Chand and Company Ltd. , Ram Nagar, New Delhi – 55
2. Aggarwal R.S., Arithmetic Subjective and Objective for Competitive Examinations (Revised Edition 2011), S.Chand and Company Ltd. , Ram Nagar , New Delhi – 55.
3. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGrawHill Publishing Company Ltd., New Delhi.

6. Verified by subject Expert:

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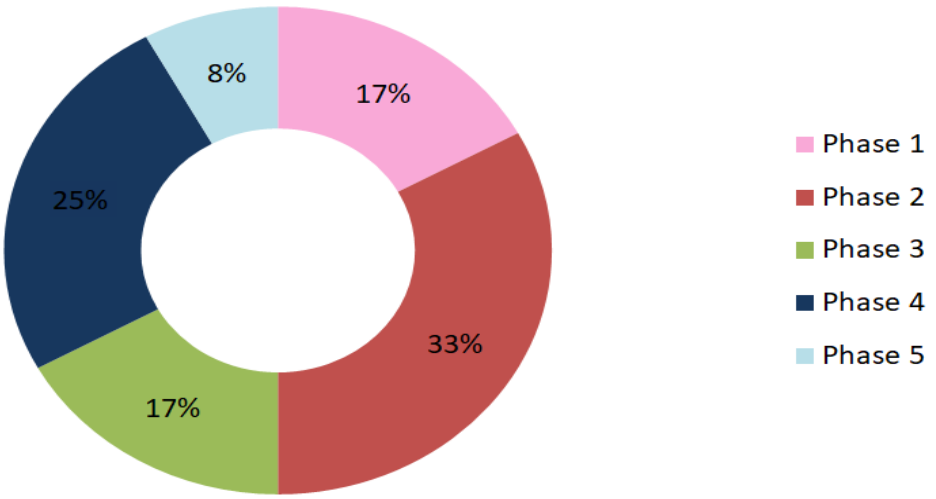
Lesson Plan

Programme	B. Sc Mathematics
Semester	V
Course Title	Computer Oriented Numerical Methods
Code	21UCMC51
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit II: Numerical Integration
Name of the Faculty	Dr. V.L. Stella Arputha Mary
T-L tools	Mind Maps, Video, Art Project, Think-Pair-Share

Pre-requisite Knowledge

- Basic integration techniques
- Elementary error analysis
- Concepts of definite integrals

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Introduction to the concept and necessity of numerical integration	10 min
Phase 2:Rule-Based Techniques	Derive and demonstrate Trapezoidal Rule and Simpson's 1/3 Rule	20 min
Phase 3: Error Analysis	Analyze errors and convergence properties of each method	10 min
Phase 4: Applications& Discussion	Apply rules to approximate definite integrals of real fuctions	15 min
Phase 5: Assessment & Recap	Quick quiz and group discussion	5min

1.Topics for Learning Through Evocation

- Discuss where exact integration fails (e.g., no closed-form integral)
- Ask students to estimate area under curves with real-life examples

2.Topic Introduction

2.1: General Objectives:

- Introduce numerical integration as a tool for approximating definite integrals
- Highlight the efficiency and limitations of different methods

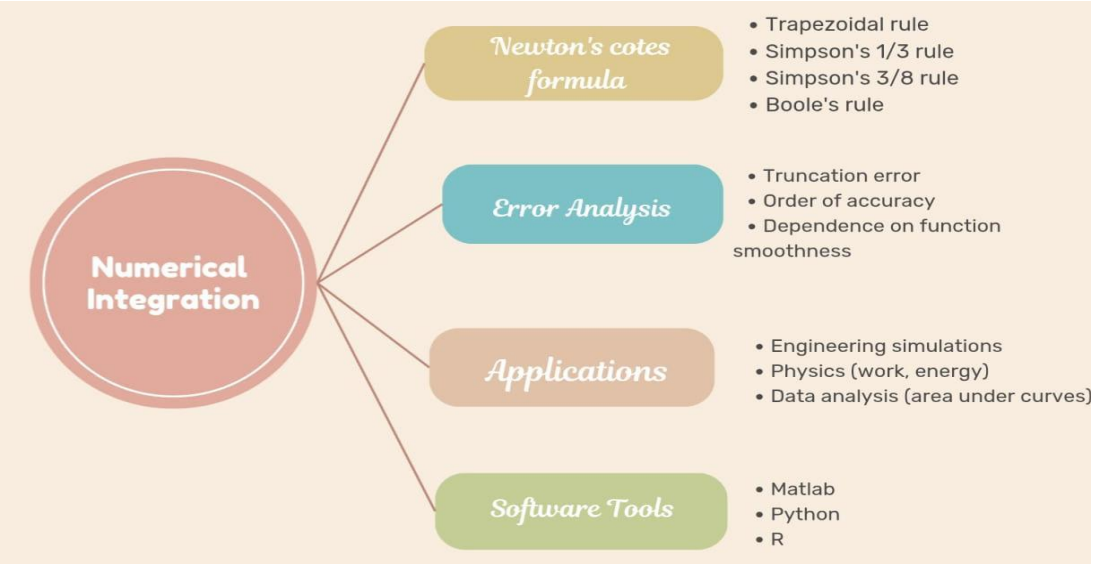
2.2: Specific Outcomes:

- **SO1**: Understand the Trapezoidal and Simpson's Rules
- **SO2**: Apply rules to compute numerical integrals
- **SO3**:Analyze and compare errors in different methods

2.3: Discussion & Student Engagement (10 minutes)

- Real-world examples like computing area, volumes, or physical quantities
- Group activities with graph plotting and estimating integrals

Mind Map



Summary

Numerical integration provides approximate solutions when exact ones are not possible. Trapezoidal Rule is linear; Simpson's is quadratic. Error analysis helps choose the most suitable method.

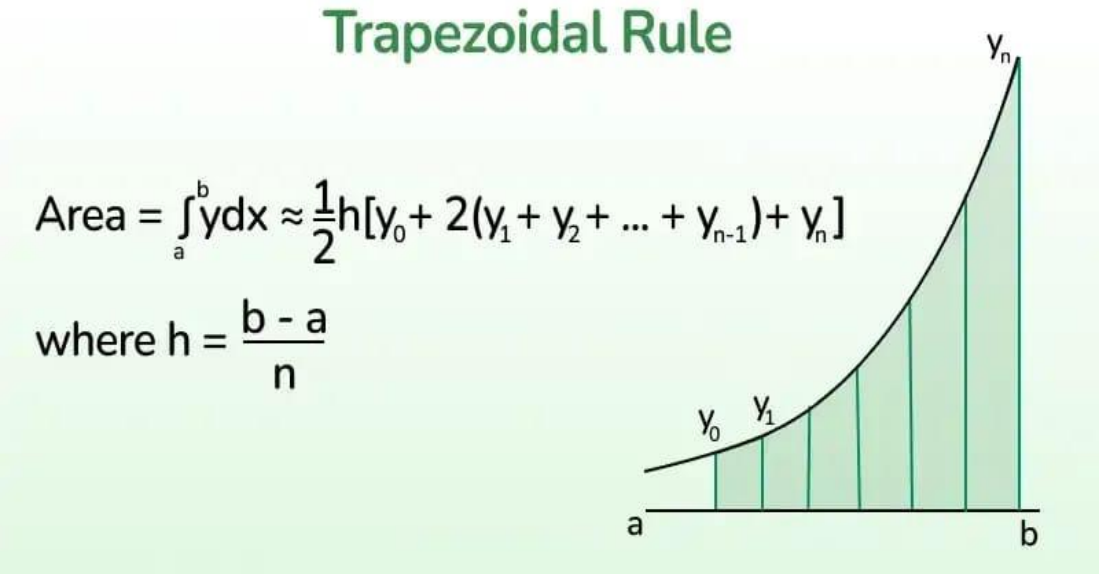
2.4: Taxonomy of Objectives

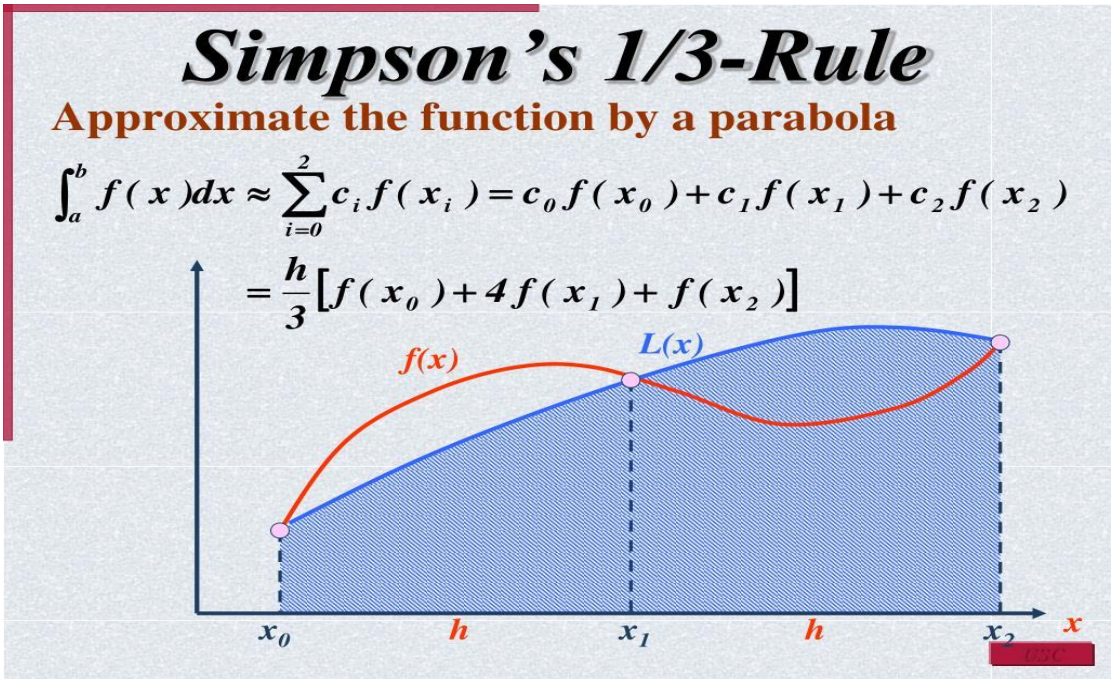
Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		1,2	3			
C. Procedural Knowledge			3	3		
D. Meta Cognitive Knowledge				3		

3.Key Terms:

- Trapezoidal Rule
- Simpson's 1/3 and 3/8 Rules
- Error Estimate
- Composite Rule
- Interpolation

4.Key Diagrams: (if any)





Powerpoint Presentation

https://docs.google.com/presentation/d/1K9-SxXZAnNgvNb75AypvV5If8sYGe3Rx/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

5.Assessment Through Questions/Analogy/New Ideas:

- **FA1:**Estimate the integral of f(x) = e^x from 0 to 1 using Trapezoidal Rule
- **FA2:**Compare Simpson's and Trapezoidal results for f(x) = sin(x)
- **FA3:**Derive error formulas for each rule

6.FAQs & Discussion Questions:

1. When is Simpson's Rule more accurate than Trapezoidal?
2. What are the assumptions behind each method?
3. How does increasing subintervals affect accuracy?
4. Real-world cases: How would you use these in engineering simulations?

7.References:

1. Arumugam S and Thangapandi Isaac A, Numerical Analysis With Programming in C, New Gamma Publishing House, Palayamkottai.
2. Gerald, C. F., & Wheatley, P. O. Applied Numerical Analysis. Pearson.
3. Burden, R. L., &Faires, J. D. Numerical Analysis. Cengage Learning.

8. Verified by subject Expert:

Course In-charge

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Lesson Plan

Programme	B. Sc Mathematics
Semester	V
Course Title	Linear Algebra
Code	21UMAC51
Hours	5
Total Hours	75
Credits	4
Max Marks	100
Unit & Title	Unit IV : Eigen values and Eigen vectors
Name of the Faculty	Dr.Sr.S. Kulandai Therese
T-L tools	Mind Maps, Project, Assignments, PPT

1. Pre-requisite Knowledge:

Basic understanding of

- Understanding of matrices and matrix operations
- Concepts of determinants and characteristic polynomials
- Basic knowledge of vector spaces

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2. Micro-Planning: (120 minutes)

3. **Topics for Learning through Evocation (10 Min)**
   - What are eigenvalues and eigenvectors?
   - Why are they important in mathematics and applied fields?
   - Real-life examples (e.g., Google PageRank, vibration modes)
4. **General Objective:**
   To develop the ability to compute and interpret eigenvalues and eigenvectors and understand their significance in linear transformations and real-world applications.
5. **Specific Outcomes:**
   SO1: Define and find eigenvalues and eigenvectors of a matrix
   SO2: Solve the characteristic equation
   SO3: Diagonalize a matrix using eigenvalues and eigenvectors
6. **Taxonomy of Objectives**

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
A. Factual Knowledge	1	1,2				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge			3	3		
D. Meta-Cognitive Knowledge						

7. **Key Diagrams:**
   - Geometric interpretation of eigenvectors (stretching/scaling direction)
   - Transformation of unit vectors
   - Diagonal matrix with eigenvalues
8. **Discussion Topics:**
   - What does an eigenvalue represent geometrically?
   - Can a matrix have no eigenvectors?
   - Real-world applications in systems of differential equations and PCA
9. **Power Point Presentation**
   https://gamma.app/docs/Eigenvalues-and-Eigenvectors-Unlocking-Linear-Transformations-3dmhjdsoehr3y63
10. **Mind Map**

Central Theme: Eigenvalues & Eigenvectors

- Branch 1: Definitions
- Branch 2: Finding Eigenvalues
- Branch 3: Computing Eigenvectors

- Branch 4: Applications (Diagonalization, System)

11. Summary

- Eigenvalues represent scaling factors in linear transformations
- Eigenvectors define invariant directions under matrix transformation
- Used widely in computer science, physics, and data science

12. Assessment Through Questions & New Ideas:

- Define eigenvalue and eigenvector
- Solve for eigenvalues of a given 2×2 or 3×3 matrix
- Find the eigenvectors corresponding to the eigenvalues
- Explain the role of eigenvectors in diagonalizing matrices

13. FAQs (MCQs & Descriptive Questions):

- What is the characteristic polynomial?
- How do you determine if a matrix is diagonalizable?
- Give real-life examples of eigenvalue applications
- Solve and interpret the eigenvalues of a 3×3 matrix

References:

- Lay, David C. *Linear Algebra and Its Applications*, Pearson
- Hoffman, Kenneth & Kunze, Ray. *Linear Algebra*, PHI
- Strang, Gilbert. *Introduction to Linear Algebra*, Wellesley-Cambridge Press

Verified by Subject Expert:

Dr. Sr. S. Kulandai Therese

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LESSON PLAN

Objective Oriented Learning Process RBT

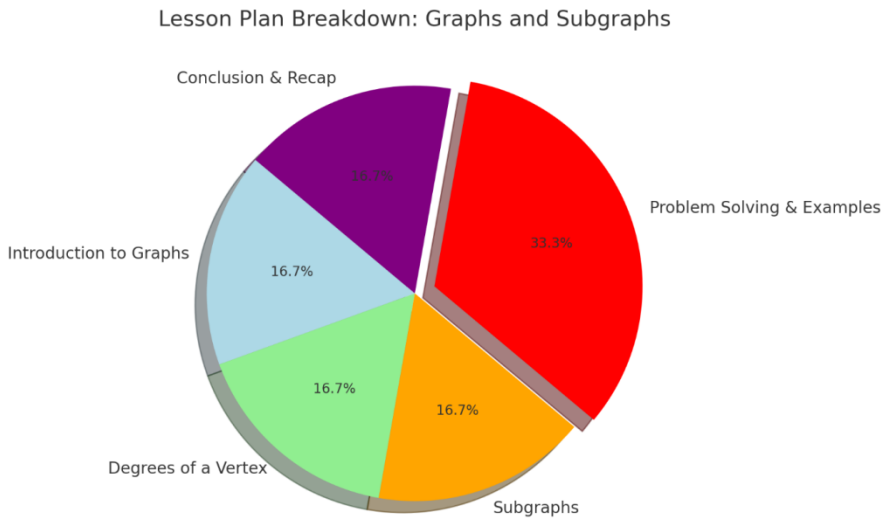
Programme	B. Sc. Mathematics
Semester	V
Course Title	Graph Theory
Code	21UMAC52
Hours	5
Total Hours	75
Credits	4
Maximum Marks	100
Unit and Title	Unit I – Graphs and sub graphs
Faculty	Dr. A. Punitha Tharani
Target Audience:	Undergraduate students

Lesson Objectives:

By the end of the lesson, students should be able to

1. Define graphs and subgraphs.
2. Identify different types of graphs with examples.
3. Explain the concept of degrees of a vertex.
4. Identify and construct subgraphs from a given graph.

Micro-Planning : 60 minutes



Lesson Component	Time (minutes)	Percentage
Introduction to Graphs	10	16.7%
Degrees of a Vertex	10	16.7%
Subgraphs	10	16.7%
Problem Solving & Examples	20	33.3%
Conclusion & Recap	10	16.7%

Lesson Structure (60 Minutes)

1. Introduction to Graphs (10 minutes)

Definition: A graph G)is a collection of vertices and edges between them.

Types of graphs:

- Undirected vs. Directed
- Simple vs. Multigraph
- Weighted vs. Unweighted

Real-life examples:

- Social networks (Facebook connections)
- Road networks (cities and highways)
- Computer networks (routers and connections)

Activity: Ask students to brainstorm real-world examples of graphs.

2. Degrees of a Vertex (10 minutes)

Degree (deg(v)): The number of edges connected to a vertex.

Types of degrees:

- In-degree and out-degree (for directed graphs)
- Even and odd degree vertices

Handshaking Lemma: The sum of degrees of all vertices in a graph is always even.

Activity: Draw a sample graph on the board and ask students to calculate the degree of each vertex.

3. Subgraphs (10 minutes)

Definition: A subgraph is a part of a graph formed by selecting some vertices and edges from the original graph.

Types of subgraphs:

- Induced subgraph (keeping all edges between selected vertices)
- Spanning subgraph (contains all vertices but fewer edges)

Example: Extracting a smaller network from a social graph.

Activity: Given a graph, students will identify and draw possible subgraphs.

4. Problem Solving and Examples (20 minutes)

Example 1: Identify the degrees of all vertices in a given graph.

Example 2: Draw a subgraph from a given graph by removing one vertex and related edges.

Example 3: Verify the handshaking lemma with a simple graph.

Activity: Pair students to solve graph-related problems and present solutions.

Conclusion & Recap (10 minutes)

- Quick summary of key concepts.
- Q&A session to clarify doubts.

Homework assignment:

Draw a graph with at least 6 vertices and identify different subgraphs.

Course In-Charge

Dr. A. Punitha Tharani

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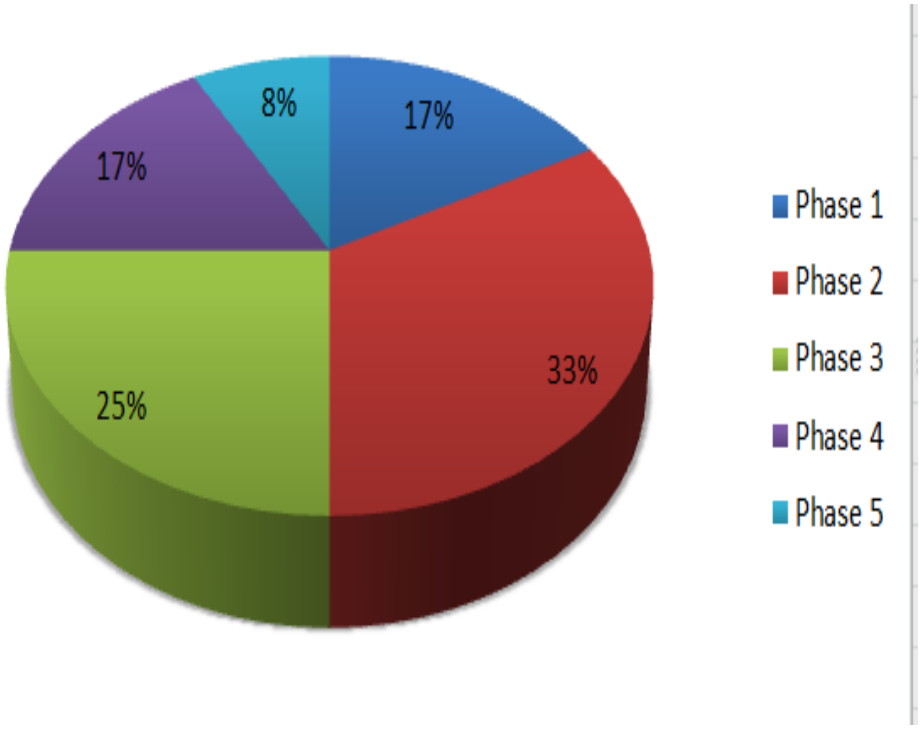
Lesson Plan

Programme	B.Sc. Mathematics
Semester	V
Course Title	Real Analysis
Code	21UMAC53
Hours	4
Total Hours	60
Credits	4
Max. Marks	100
Unit & Title	Unit I: Continuous Functions
Name of the Faculty	Dr. G. Priscilla Pacifica
T-L tools	Mind Maps, Group Discussion, Think-Pair-Share

Pre-requisite Knowledge

- Basic understanding of limits and sequences
- Knowledge of functions and their properties.

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Definition and basic understanding of continuity. Examples and counterexamples	10 min
Phase 2: Exploration	Types of discontinuities (removable, jump, essential). Understanding limits and epsilon-delta definition	20 min
Phase 3: Theorems and Properties	Intermediate Value Theorem (IVT), Extreme Value Theorem (EVT). Operations on continuous functions.	15 min
Phase 4: Application & Discussion	Real-world applications (Physics, Economics, Engineering). Think-Pair-Share and problem-solving.	10 min
Phase 5: Assessment & Recap	Quick quiz and summary of key points. Mind map representation.	5 min

Mind Map : 2 min

Summary : 2 min

1.Topics for Learning Through Evocation:

- Brief introduction to continuity in real-world scenarios (e.g., temperature changes, motion)
- Ask students about functions they encounter in daily life and their smoothness.

2.Topic Introduction:

2.1: General Objectives:

- To introduce the concept of continuity and its significance in mathematical analysis
- To explore real-world applications of continuous functions

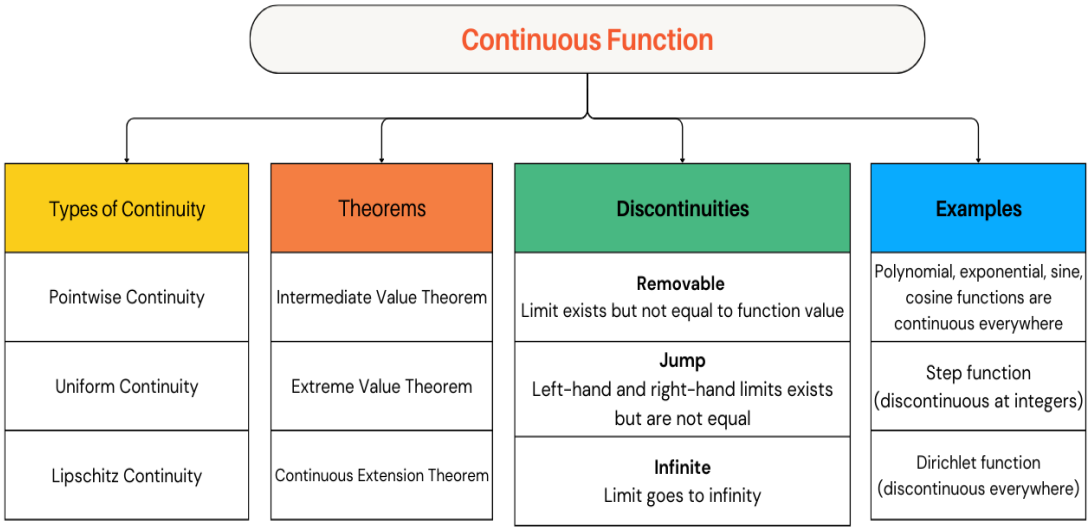
2.2: Specific Outcomes:

- SO1: Understand the definition of continuous functions and key properties
- SO2: Learn and apply different tests for continuity, such as epsilon-delta definition, sequential criterion, and intermediate value theorem

2.3: Discussion & Student Engagement (10 minutes):

- Encourage students to think of examples of continuous functions in physics, engineering, or economics.
- Use a Think-Pair-Share method where students analyze a given function and determine its continuity.

Mind Map (2 minutes)



Summary (2 minutes)

Recap key points: Definition, types, and applications of continuous functions.

2.4: Taxonomy of Objectives:

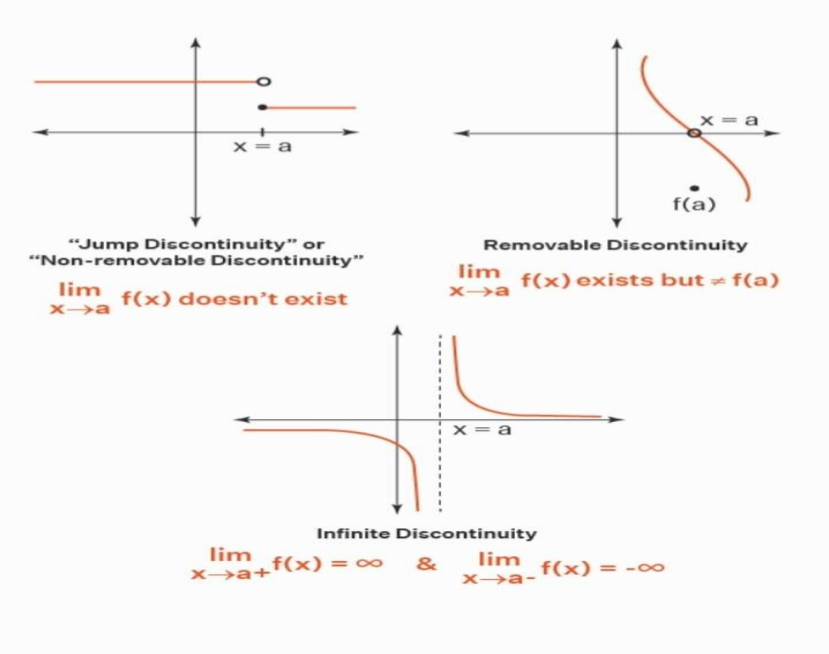
Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1	2				
B. Conceptual Knowledge			1	1		
C. Procedural Knowledge					2	1
D. Meta Cognitive Knowledge						

2.5: Key words:

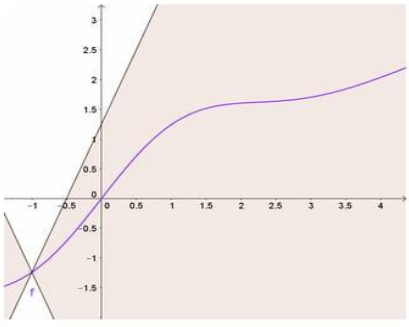
- Continuity
- Limits
- Epsilon-delta definition
- Intermediate Value Theorem
- Discontinuity
- Uniform Continuity.

2.6: Key Diagrams:

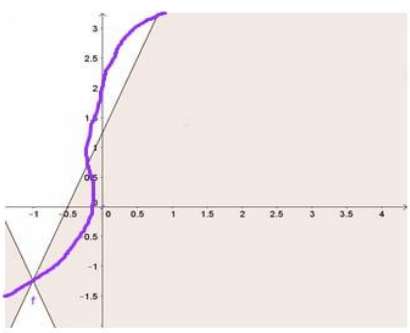
Discontinuity



Lipschitz continuity



Non-Lipschitz continuity



Powerpoint Presentation

https://docs.google.com/presentation/d/1ysGgpmIM8IlneIh6IIxq9m8-1FLzh-l8/edit?usp=drive_link&ouid=110814056293057288983&rtpof=true&sd=true

https://docs.google.com/presentation/d/1BFa2tDC_tZPmWFdI-ThPkDpTSQwZycdc/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

https://docs.google.com/presentation/d/1BEN_bSB1uYYK9dfgEhTYNl4LQUD0DRHq/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

3. Assessment through Questions/Analogy/New Ideas:

- FA1: Given a function, determine whether it is continuous at a point.
- FA2: Apply the Intermediate Value Theorem to solve a real-world problem.

4. FAQs & Discussion Questions:

1. Define a continuous function in your own words.
2. Give an example of a function that is discontinuous at a point and explain why.
3. Explain the importance of the Intermediate Value Theorem in real analysis.
4. How does uniform continuity differ from pointwise continuity?

5. References:

1. Bartle, R. G., & Sherbert, D. R. *Introduction to Real Analysis.* Wiley, 2011.
2. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co., New Delhi. Reprint 1973
3. Ajit Kumar and S. Kumaresan, Real Analysis, Crc Press, 2015.

6. Verified by subject Expert:

Course In-charge

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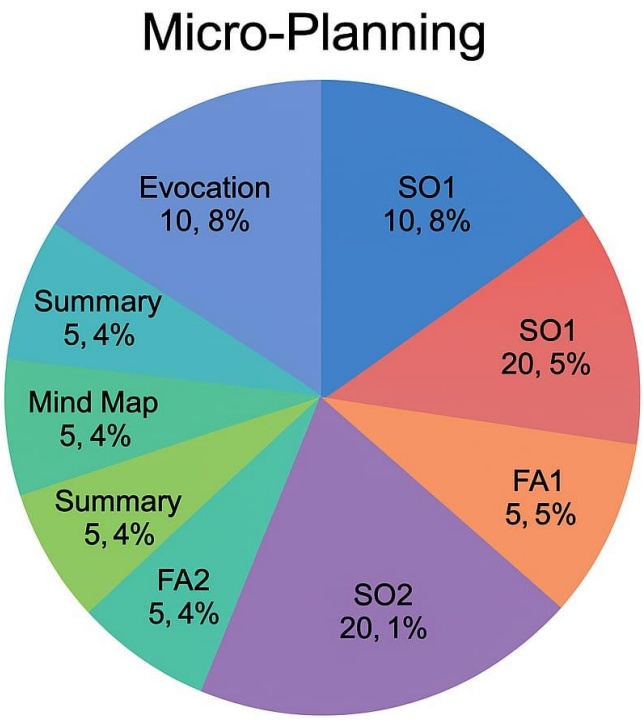
Lesson Plan

Programme	B. Sc Mathematics
Semester	V
Course Title	Vector Calculus and Fourier Series
Code	21UMAC54
Hours	4
Total Hours	60
Credits	4
Max Marks	75
Unit & Title	Unit II – Divergence and Curl – Solenoidal, Irrotational
Name of the Faculty	Dr. J. Arul Jesti
T-L tools	Mind Maps, 3D Models, Worksheets

Pre-requisite Knowledge

- Basics of vector algebra
- Gradient, dot product, and cross product
- Multivariable calculus concepts.

Micro -Planning (120 Minutes)



Topics for Learning through Evocation (10 Min)

- Introduction to vector fields in physics and engineering
- Real-life applications of divergence and curl (fluid flow, electromagnetism)

General Objective

- To introduce the concepts of divergence and curl, and enable students to analyze vector fields for solenoidal and irrotational properties.

Specific Outcomes

- • SO1: Understand and calculate the divergence of a vector field.
- • SO2: Understand and calculate the curl of a vector field.
- • SO1: Identify and classify solenoidal vector fields.
- • SO2: Identify and classify irrotational vector fields.

First Phase (SO1 & SO2)

- SO1: Divergence (30 min)
  - Definition, formula, physical interpretation
  - Examples and applications
- SO2: Curl (20 min)
  - Definition, formula, interpretation
  - Examples and applications
- FA1: Simple problems to calculate divergence and curl (5 min)

Second Phase (SO1 & SO2)

- SO1: Solenoidal Fields (30 min)
  - Definition, condition (divergence = 0)
  - Examples and importance
- SO2: Irrotational Fields (15 min)
  - Definition, condition (curl = 0)
  - Potential functions
- FA2: Problems involving verification of solenoidal/irrotational nature (5 min)

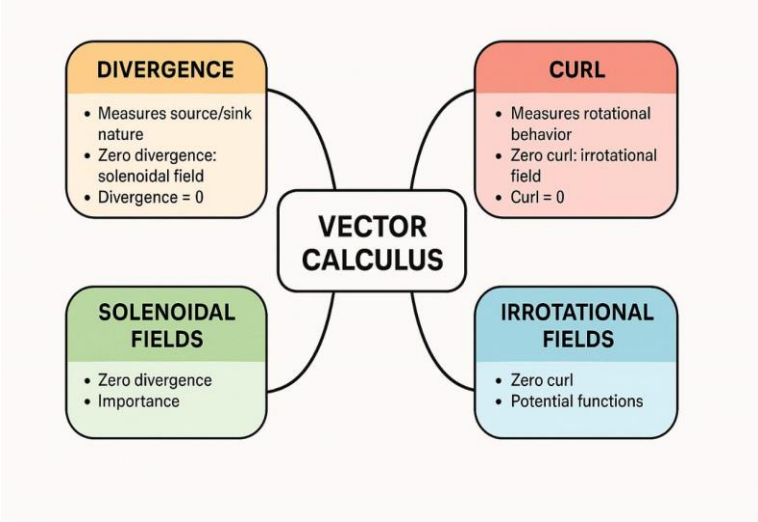
Discussion Topics (5 Min)

- Vector field behavior in fluid dynamics and electrostatics
- Use of solenoidal and irrotational conditions in practical problems

Mind Map (5 Min)

Central Theme: Vector Calculus

- Branch 1: Divergence
- Branch 2: Curl
- Branch 3: Solenoidal Fields
- Branch 4: Irrotational Fields



Summary (5 Min)

- Divergence measures the source/sink nature of a vector field.
- Curl measures the rotational behavior of a vector field.
- Solenoidal fields have zero divergence.
- Irrotational fields have zero curl and admit potential functions.

Assessment Through Questions & New Ideas

- Compute the divergence and curl of a given vector field.
- Determine whether a vector field is solenoidal or irrotational.
- Discuss real-life applications of divergence and curl.
- Find a potential function for an irrotational vector field.

FAQs (MCQs & Descriptive)

1. Define divergence and give its formula.
2. What does curl represent in vector calculus?
3. What is the condition for a field to be solenoidal?
4. Explain how to check if a field is irrotational.
5. Find whether F = xi + yj + zk is solenoidal or irrotational.

References

Text Books:

1. Arumugam S. and Thangapandi Isaac A, Analytical Geometry of Three Dimensions and Vector Calculus, New Gamma Publishing House, Edition 2014.

2. Arumugam S. and Thanga Pandi Isaac A, Calculus, New Gamma Publishing House, Edition 2014.

Books for Reference:

1. Durai Pandian P and Laxmi Durai Pandian, Vector Analysis, Emerald Publishers Edition 1986.
2. Piskunov N, Differential and Integral Calculus, Vol II, CBS Publishers and Distributors.

Verified by Subject Expert

Course In-Charge
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LESSONPLAN

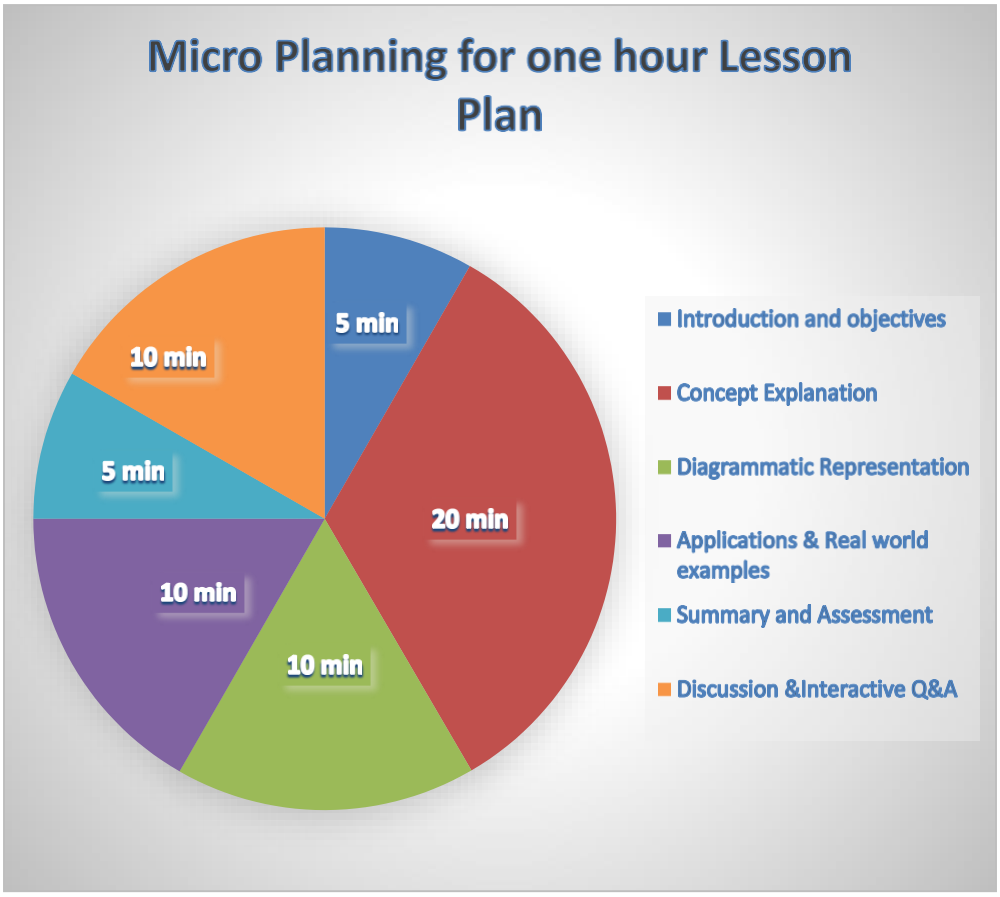
Objective Oriented Learning Process RBT

Programme	B.Sc.Mathematics
Semester	V
Subject Title	Core Elective – Discrete Mathematics
Code	21UMAE51
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	Unit:III – Special types of graphs
Name of the Faculty	Dr.A.Punitha Tharani
T-Ltools	**Lecture method, PPT, Group Discussion**

Prerequisite Knowledge:

Knowledge of Basic concepts of graph theory such as vertices, edges, degree, paths, cycles, connectedness & types of graphs like simple and directed graphs is required.

Micro-planning



1. Topic for Learning through evocation

This topic introduces students to various special types of graphs in graph theory.Understanding these graphs is crucial for solving real-world problems in computer science, operations research, and network analysis.

2. Topic Introduction:

Graph models are used to represent complex relationships in various fields such as computer science, transportation,social networks and biology.This lesson covers different types of graph models and their applications.

General Objective:

To introduce students to different graph models and their significance in representing real-world problems.

Specific Objectives:

By the end of this lesson, students will be able to:

1. Understand the importance of graph models.
2. Identify different types of graph models.
3. Analyze real-world scenarios using graph models.
4. Apply graph models to problem-solving in various domains.

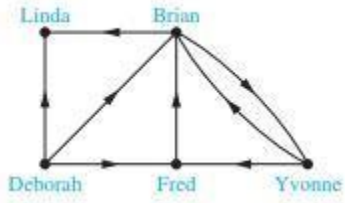
Taxonomy of objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
A.Factual Knowledge	1,2	1,2				
B.Conceptual Knowledge		1,2	3			
C.Procedural Knowledge			3,4	3		
D.Meta-Cognitive Knowledge				3,4	4	4

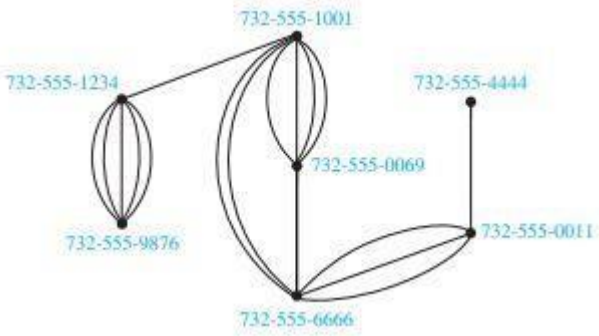
Keywords : Graph Models, Social Network Graphs,Transportation Graphs, Biological Networks, Web Graphs, Computational Graphs

Key diagrams :

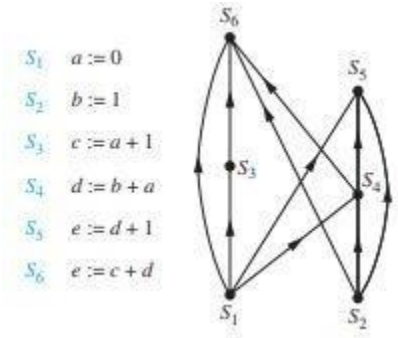
- **InfluenceGraph**



- **Call Graph**



- **Precedence Graph**

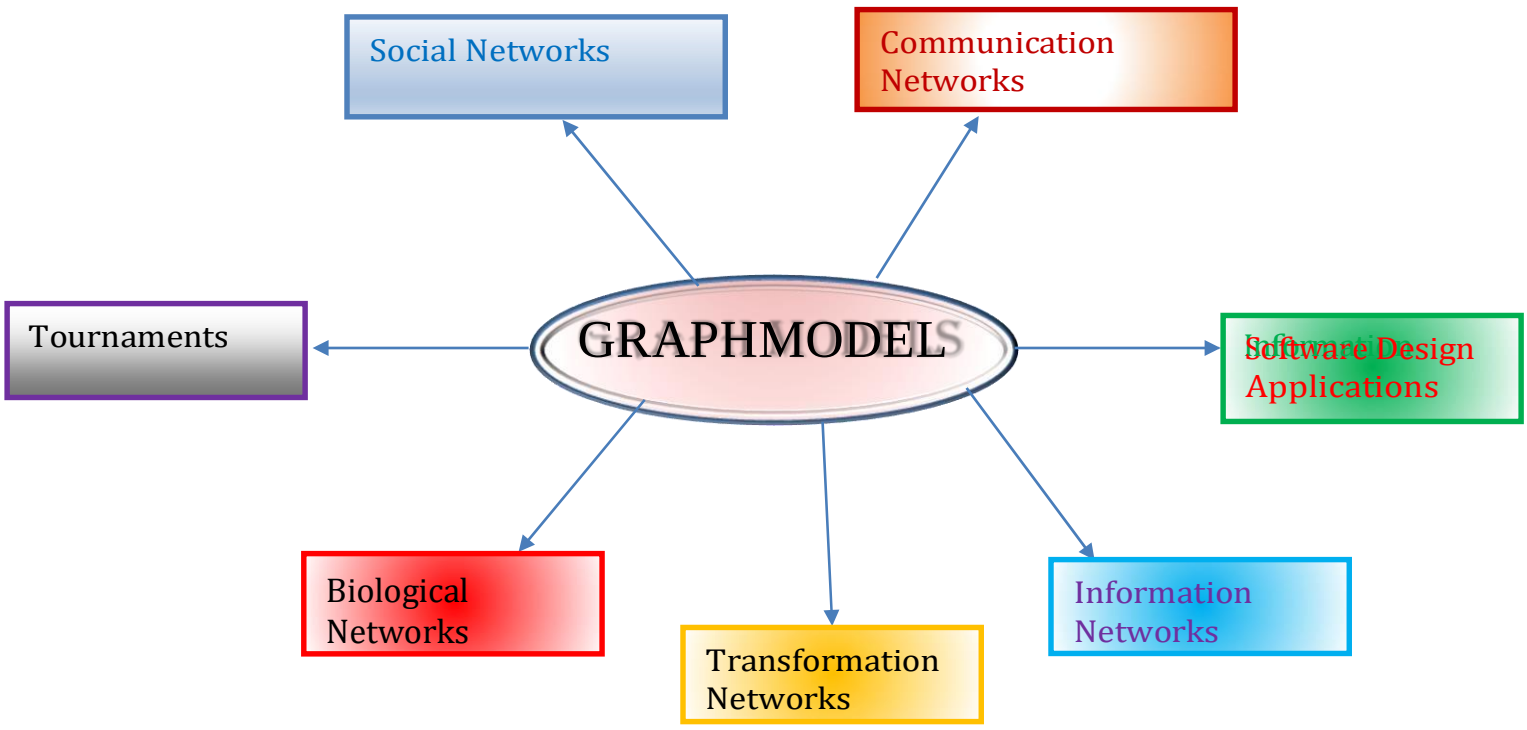


- **Single Elimination Tournament**

3. Discussion:

a) **Social Network Graphs :** How they represent relationships and influence in social platforms.
b) **Transportation Graphs :** Modeling routes, shortest paths and traffic flow.
c) **Biological Networks :** Representation of biological processes and genetic interactions.
d) **Web Graphs :** Structure of the internet and hyperlink networks.
e) **Computational Graphs :** Use dinoptimization, AI, and deep learning.

4. Mind Map



5. Summary:

This lesson provided an overview of graph models and their applications.Various types of graphs were discussed with examples from different fields, emphasizing their importance in problem-solving.

6. Assessment:

- **Formative :** In-class discussions, quizzes
- **Summative:** Assignments analyzing different graph models

7. FAQs:

a) What is a graph model?
b) Why are social networks represented as graphs?
c) How transportation networks are modeled using graphs?
d) How do web graphs influence search engines?

8. References:

1. Douglas B.West, *Introduction to Graph Theory*
2. Narsingh Deo,*Graph Theory with Applications to Engineering and Computer Science*
3. Online resources and research papers on graph theory applications

Verified By Subject Expert

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Lesson Plan

Programme	B. Sc Mathematics
Semester	VI
Course Title	Complex Analysis
Code	21UMAC61
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit V : Cauchy Residue Theorem
Name of the Faculty	Dr.Sr.S. Kulandai Therese
T-L tools	Mind Maps, Art Project, Think-Pair-Share

1. Pre-requisite Knowledge:

Basic understanding of

- Contour integration and Cauchy-Goursat Theorem
- Complex functions and analyticity
- Laurent series expansions
- Types of singularities (removable, poles, essential)

Motivation / Warm-up Activity

Quick Review: 10–15 minutes
Ask students to:

- Sketch simple contours
- Define and identify singularities
- Expand $f(z) = \frac{1}{(z-1)^2(z+2)}$ around its singular points
- **Discussion Prompt:**
- "What challenges arise when evaluating integrals of functions with singularities inside the contour? How might we handle these singularities effectively?"

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2. Micro-Planning: (120 minutes)

3. Topics for Learning through Evocation (10 Min)

- Motivation for using the Residue Theorem
- Significance of singularities in complex analysis
- Real-world examples involving complex integrals

4. General Objective:

To enable students to evaluate complex integrals using Cauchy's Residue Theorem and understand the role of singularities and residues in complex analysis.

Specific Outcomes:

1. Define singularities and classify them
2. Compute residues at poles of various orders
3. Apply Cauchy’s Residue Theorem to evaluate complex and real integrals
4. Compute a sample triple integral (5 min)

5. Taxonomy of Objectives

Taxonomy of Objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
A. Factual Knowledge	1	1,2				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge			3	3		
D. Meta-Cognitive Knowledge					4	

5. Key Diagrams:

- Contour enclosing singularities
- Sample poles in the complex plane
- Paths of integration for practical problems

6. Discussion Topics:

- Classification of singularities (removable, poles, essential)
- Use of the theorem in evaluating real integrals
- Physical interpretations in engineering and physics

7. Mind Map

Central Theme: Cauchy's Residue Theorem

- **Branch 1**: Singularities
- **Branch 2**: Residue Calculation
- **Branch 3**: Theorem Statement & Application
- **Branch 4**: Real-World Use Cases

8. Summary

- Residues help simplify evaluation of complex integrals
- The theorem applies to functions with isolated singularities inside closed contours
- Residue calculus is essential in mathematical physics and engineering

9. Power Point Presentation

https://gamma.app/docs/Cauchys-Residue-Theorem-b3f2cogiykwywyc

10. Assessment Through Questions & New Ideas:

- Define and classify singularities
- Find the residue of a given function at a pole
- Evaluate an integral using Cauchy's Residue Theorem
- Solve a real integral using contour integration

11. FAQs (MCQs & Descriptive Questions):

- What is a residue?
- How do you classify singularities?
- State Cauchy's Residue Theorem
- Why is this theorem useful in solving real integrals?

12. References:

- Churchill, R.V., & Brown, J.W. *Complex Variables and Applications*, McGraw-Hill
- Saff, E.B., & Snider, A.D. *Fundamentals of Complex Analysis*, Pearson
- Bak, J., & Newman, D.J. *Complex Analysis*, Springer

Verified by Subject Expert:

Dr. Sr. S. Kulandai Therese

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LESSON PLAN

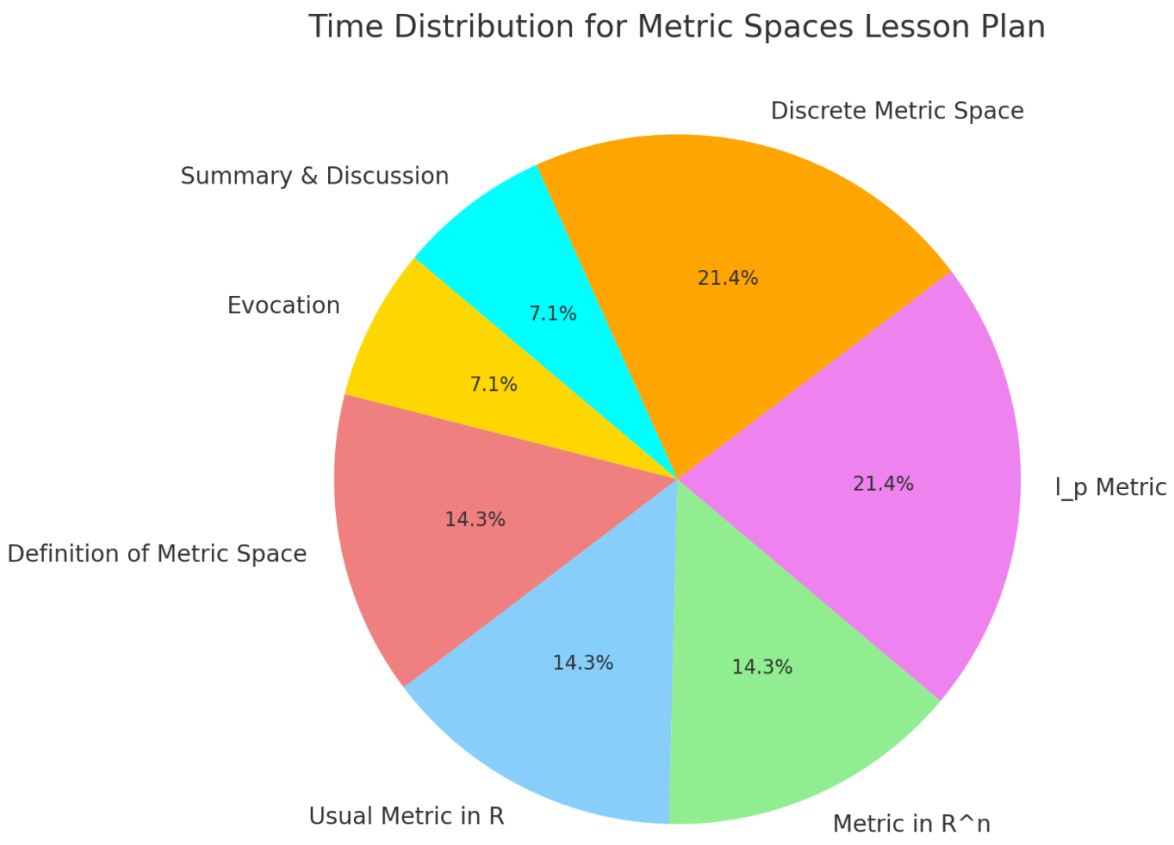
Programme	B. Sc. Mathematics
Semester	VI
Course Title	Modern Analysis
Code	21UMAC62
Hours	6
Total Hours	90
Credits	5
Maximum Marks	100
Unit and Title	Unit I – Metric Spaces
Faculty	Dr. A. Punitha Tharani

Objective Oriented Learning Process RBT

Pre-requisite Knowledge:

- Basic set theory concepts
- Understanding of real numbers and functions
- Knowledge of open and closed intervals

Micro-Planning : 60 minutes



Phase	Activity	Time (min)
Evocation	Introduction to Metric Spaces	5
SO1	Definition of Metric Space	10
SO2	Usual Metric in R	10
SO3	Metric in R^n	10
SO4	l_pMetric	15
SO5	Discrete Metric Space	15
Summary	Key Takeaways and Discussion	5

1. Evocation: (5 min)

Topics for Learning through Evocation:

- Ask students about their understanding of distances in real life (e.g., measuring distances between cities,

  Manhattan distances in grids, etc.).
- Introduce the motivation behind formalizing distances in mathematics.

2. Topic Introduction:

2.1: General Objective:

- To introduce metric spaces and different types of metrics.
- To explore fundamental examples of metric spaces used in real analysis.

2.2: Specific Outcomes:

- SO1: Define metric spaces formally and understand their significance.
- SO2: Explain the usual metric in real numbers R.
- SO3: Extend the concept to $R^n$with Euclidean metric.
- SO4: Discuss the l_p metric and its generalization.
- SO5: Introduce and explain the discrete metric space.

2.3: Teaching Methodology:

- Lecture-based Explanation (Definition, Examples, Theorems)
- Visual Aids (Graphical Representations, Mind Maps)
- Collaborative Discussion (Think-Pair-Share, Applications)
- Problem-solving Approach (Example Problems, Conceptual Questions)

3. Lesson Structure:

Phase 1: Exploration (50 min)

- SO1 (10 min): Define metric spaces with examples (axioms of a metric, triangle inequality, symmetry, etc.).
- SO2 (10 min): Explain the usual metric in real numbers $d(x, y) = | x - y |$with properties and simple examples.
- SO3 (10 min): Extend to $R^n$with the Euclidean metric $d(x, y) = \sqrt{\sum (x_i - y_i)^2}$
- SO4 (15 min): Introduce the l_p metric $d_p(x, y) = \sqrt[1/p]{\sum |x_i - y_i|^p}$ and discuss its significance.
- SO5 (15 min): Explain the discrete metric $d(x, y) = 1$ for $x \neq y$and $d(x, x) = 0$, including examples and applications.

Phase 2: Summary and Discussion (10 min)

- Summary (5 min): Reinforcing learning outcomes and summarizing key concepts.
- Discussion (5 min): Applications of different metric spaces in analysis, machine learning, and optimization.

4. Key Diagrams & Illustrations:

- Graphs showing open and closed balls in different metric spaces.
- Visual representation of Euclidean and Manhattan distances.

5. Discussion Questions:

1. Why do we need different types of metrics in mathematics?

2. How do metric properties change in l_p spaces for different values of p?
3. What are some real-world applications of metric spaces?

6. References:

1. Rudin, W. (1976). *Principles of Mathematical Analysis*. McGraw-Hill.
2. Munkres, J. (2000). *Topology: A First Course*. Prentice Hall.
3. Sutherland, W. (2009). *Introduction to Metric and Topological Spaces*. Oxford University Press.

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LESSONPLAN

Programme	B. Sc Mathematics
Semester	III
Course Title	Machanics
Code	21UMAC63
Hours	4
Total Hours	60
Credits	4
Max Marks	75
Unit & Title	Unit III- Friction and Equilibrium on Inclined Plane
Name of the Faculty	Dr. J. Arul Jesti
T-L tools	Chalk and Talk, Diagrams, Real-life Demonstrations, Worksheets

Pre-requisite Knowledge

- Newton's Laws of Motion
- Concept of force and equilibrium
- Inclined plane motion basics

Topics for Learning through Evocation (10 Min)

- Introduction to friction with everyday examples
- Demonstration: block on inclined plane with and without friction

General Objective

- To understand the laws and mechanics of friction and solve problems involving equilibrium of particles on rough surfaces.

Specific Outcomes

- SO1: Explain and apply laws of friction.
- SO2: Derive angle of friction and cone of friction.
- SO1: Analyze equilibrium of a particle on a rough inclined plane.
- SO2: Apply force resolution to solve equilibrium problems.

First Phase (SO1 & SO2)

- SO1: Laws of Friction (30 min)
  Static and kinetic friction

Limiting friction and coefficient

- SO2: Angle and Cone of Friction
  Definitions, derivations
  Geometrical interpretation

Second Phase (SO1 & SO2)

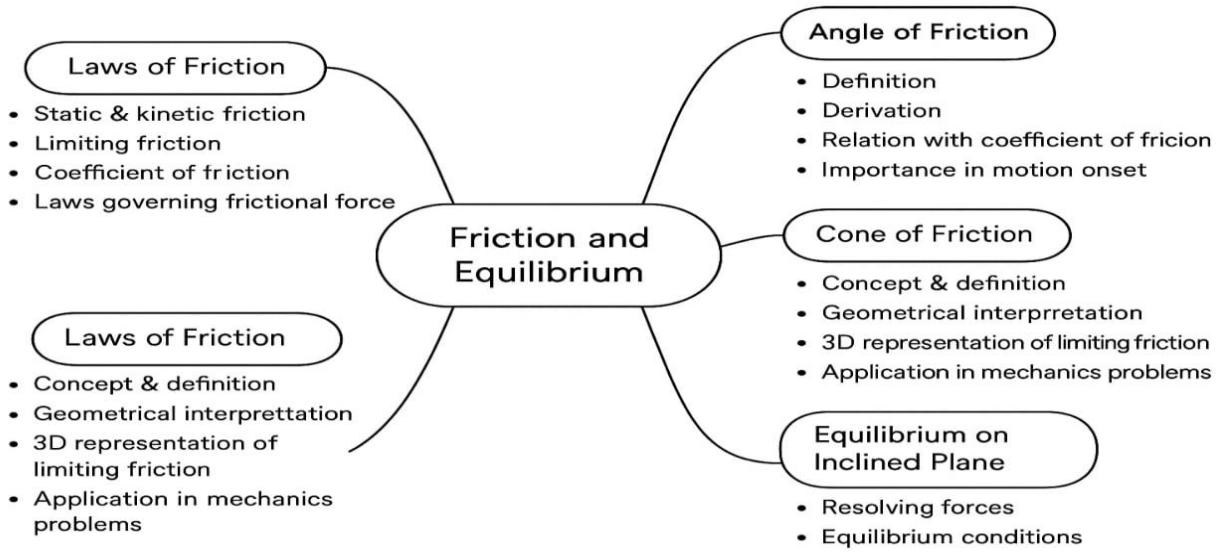
- SO1: Equilibrium on Rough Inclined Plane (30 min)
  Resolving forces
  Conditions for equilibrium
- SO2: Application of External Force (15 min)
  Along incline and horizontal force
  Minimum and maximum force required
- FA2: Problem solving – Equilibrium on inclined plane (5 min)

Discussion Topics (5 Min)

- Role of friction in engineering
- Real-life importance of angle of friction and cone of friction

Mind Map (5 Min)

Central Theme: Friction and Equilibrium
Branch 1: Laws of Friction
Branch 2: Angle of Friction
Branch 3: Cone of Friction
Branch 4: Equilibrium on Incline



Assessment Through Questions & New Ideas

- State and explain laws of friction.
- Derive the relation for angle of friction.
- Explain cone of friction with diagram.
- Solve a problem involving equilibrium of a particle under a force.

FAQs (MCQs & Descriptive)

1. What is limiting friction?
2. How is angle of friction related to coefficient of friction?
3. Define cone of friction.
4. What is the condition for equilibrium on a rough inclined plane?
5. A block of mass 10kg is placed on a rough incline. Find the force required to just m it up.

References

Text Books:

- 1. Venkatraman, M.K. Statics, Agasthiar Book House, Tiruchirapalli, Aug 2011.
- 2. Venkatraman, M.K. Dynamics, Agasthiar Book House, Tiruchirapalli, 16th Edition, J 2014.

Books for Reference:

- 1. Duraipandian P., Mechanics, S. Chand and Company Ltd.
- 2. Bali N.P., Dynamics, Laxmi Publication, Delhi.

Verified by Subject Expert

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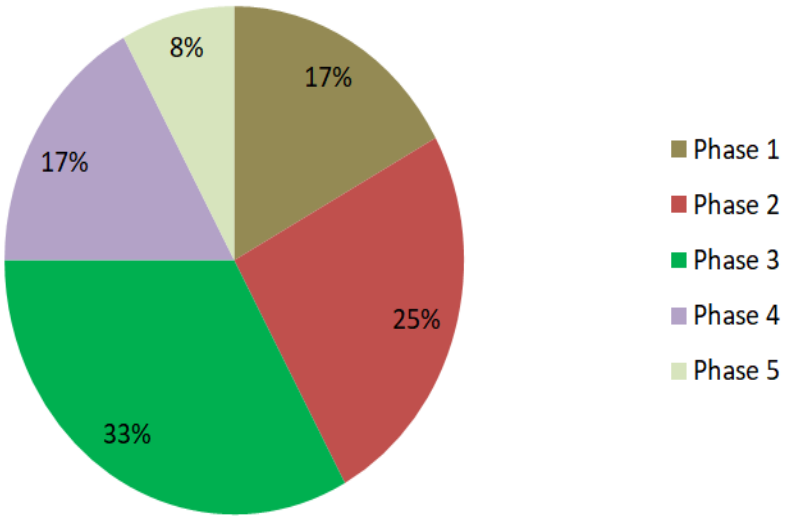
Lesson Plan

Programme	B. Sc Mathematics
Semester	VI
Course Title	Operations Research
Code	21UMAC64
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit I: Linear Programming Problem
Name of the Faculty	Dr. V.L. Stella Arputha Mary
T-L tools	Mind Maps, Video, Think-Pair-Share

Pre-requisite Knowledge

- Concepts of inequalities and systems of linear equations.
- Objective function and constraints.

Micro-Planning Scheme (60 minutes per session)



Phase	Activity	Duration
Phase 1: Introduction	Overview and importance of LPP ; real-life scenarios	10 min
Phase 2: Formulation	Converting word problems into LPP models (objective function, constraints)	15 min
Phase 3: Solution methods	Graphical method for 2-variable problems; feasible region and corner point method	20 min
Phase 4: Interpretation	Interpretation of results; Infeasibility , unbounded solutions	10 min
Phase 5: Assessment & Recap	Quick problems ,group discussion, summary of key points	5min

1.Topics for Learning Through Evocation

- Discuss applications: assignment problem, transportation and business optimization.
- Ask students to describe any personal experience with resource allocation.

2.Topic Introduction

2.1: General Objectives:

- To enable students to model and solve real-world problems using Linear Programming techniques.

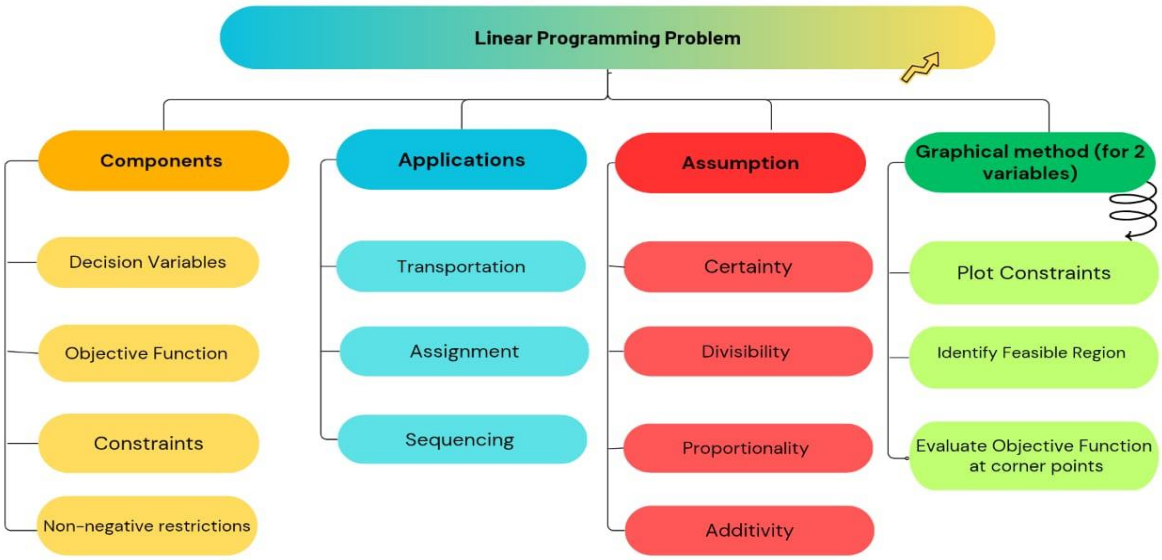
2.2: Specific Outcomes:

- **SO 1**: Formulate real-life problems as Linear Programming Problems.
- **SO 2**: Solve LPPs graphically(2-variable case).
- **SO 3**:Analyze feasibility, boundedness, and optimality.
- **SO 4**:Interept the solution in the context of the original problem.

2.3: Discussion & Student Engagement

- Group activity: Formulate LPP from a business problem.
- Use spreadsheet or graphical software for visualization.

Mind Map



Summary

LPPs are mathematical techniques used to optimize resources within given constraints. The graphical method helps visualize the feasible region and determine the optimal value of the objective function. Applications range from logistics and supply chains to finance and agriculture.

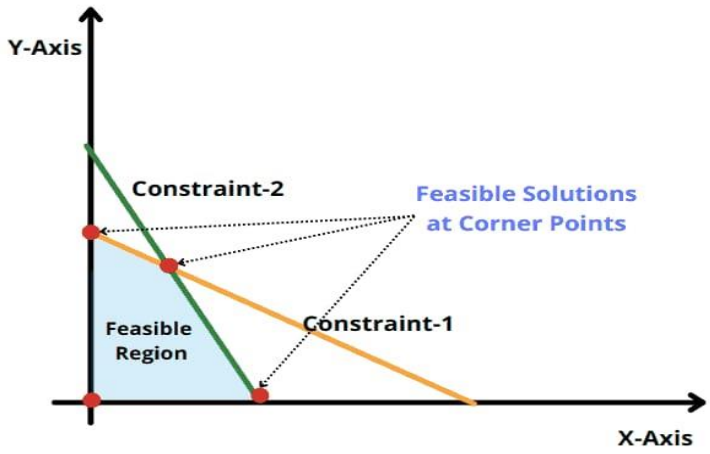
2.4: Taxonomy of Objectives

Taxonomy of objectives						
Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyse	Evaluate	Create
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge			1		2	
C. Procedural Knowledge			3	3	4	
D. Meta Cognitive Knowledge				3		

3.Key Terms:

- Linear Programming
- Objective Function.
- Constraints
- Feasible Region
- Corner Point
- Optimal Solution
- Unbounded / Infeasible solution

Keydiagrams: (if any)



Powerpoint Presentation:

https://docs.google.com/presentation/d/1KUzjpXYgroIdyiEGqnn0Wfz3RgLOOj9b/edit?usp=drivesdk&ouid=115291083755644247696&rtpof=true&sd=true

5.Assessment Through Questions/Analogy/New Ideas:

- **FA1:** Formulate an LPP from a business scenario.
- **FA2:** Solve an LPP using graphical method and interpret solution.

6.FAQs & Discussion Questions:

1. What happens if two constraints overlap?
2. Why is the optimal solution always at a vertex of the feasible region?
3. Can LP be used in non-mathematical fields like marketing or HR?
4. When does an LPP have no solution?

7.References:

1. Kantiswarup, P.K. Gupta, and Manmohan: Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi, Reprint 2013.
2. Prem Kumar Gupta and Hira D.S: Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi – 2.
3. Billy E Gillet: Introduction to Operations Research, Tata McGraw Hill publishing Company, New Delhi

8. Verified by subject Expert:

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