Department of Civil Engineering

Details of Lesson Plan

S. No.	Particulars	Details
1.	Course Name	Engineering Mathematics-I
2.	Course Code	BSC-101
3.	Academic Year	2024-25
4.	Semester	IST
5.	Number of Lesson plans	42
6.	Faculty Assigned	Dr Pallavi Sharma

Pallavi

Faculty Signature

Lesson Plan No. 1.1	Course Name: Engineering Mathematics Topic: Leibnitz theorem	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Successive Derivatives. b. Implementation of the nth order derivatives on the product of two functions using Leibnitz''s theorem. c. Apply the concept of Leibnitz''s theorem to solve various problems.
Teaching Aids (if any)	a. ICT
Teaching Development	1. **Introduction** (5 minutes) - Ask questions Differentiate a given function x^n successively times? Differentiate a given function $\cos nx$ successively times? - Introduce the concept of Leibnitz Theorem. - Talk about its applications in day to day life. - Introduce the formal concept of Leibnitz Theorem by NPTEL - https://nptel.ac.in/courses/111/105/111105121/ - Highlight the important characteristics of the Leibnitz Theorem. 2. **Development** (5 minutes) a. Successive Differentiation and Leibnitz theorem. - Introduce the concept of derivative. b. Leibnitz Theorem -Introduce the concept of Leibnitz Theorem. 3. Exercise (30 minutes) – -Do various problems on finding the nth derivatives of various functions. - Do various problems on finding the higher derivatives using Leibnitz Theorem.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://freevideolectures.com/course/4224/nptel-integral-vector-calculus/34 3. Homework - Given some questions on nth derivative to solve. Spend 5 minutes to wrap up and consolidate the learnings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 2	Course Name: Engineering Mathematics Topic: Partial differentiation	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of basic meaning of bi-variate functions. b. To consolidate basic meaning of partial derivative functions. c. To learn how to confidently calculate partial derivative functions.
Teaching Aids (if any)	a. ICT
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - Output (Y) is a function of labour (X_1) and capital (X_2) . - Utility (U) is a function of the consumption of oranges (X_1) and apples(X_2). - If output (Y) is a function of labour (X_1) and capital (X_2) , say, $Y = H(X_1, X_2)$, then H_1 (X_1 ,X_2) and H2 (X_1 ,X_2) respectively are the marginal product of labour function and the marginal product of capital function. Introduce the concept of bi-variate function and Partial derivative - Talk about its applications in day to day life. - Introduce the formal concept of Partial Derivative by NPTEL - https://nptel.ac.in/courses/111/107/111107108/ - Highlight the important characteristics of the Partial Derivative function. 2. **Development** (5 minutes) a. Bi- variate functions and Partial Differentiation. - Introduce the concept of Bi-Variate Function. b. Partial Differentiation -Introduce the concept of Partial Differentiation. 3. Exercise (30 minutes) – -Do various problems on finding the Partial derivatives of various functions. - Do various problems on finding the higher Partial derivatives.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://nptel.ac.in/courses/111/107/111107108/ Homework - Given some questions on Partial derivative to solve. Spend 5 minutes to wrap up and consolidate the learnings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 3	Course Name: Engineering Mathematics Topic: Euler's theorem on homogeneous functions	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Understand the concept of homogeneous functions: • Learn Euler's theorem on homogeneous functions. • Explore its applications in economics, physics, and engineering.
Teaching Aids (if any)	a. ICT
Teaching Development	1. **Introduction** (5 minutes) • **Engage students** by asking about their prior knowledge of functions and their properties. • **Introduce the concept** of homogeneous functions: Explain the definition and provide examples, such as f(tx,ty)=f(x,y) 2. **Development (5 minutes)** • **State Euler's theorem** • **Prove the theorem**: • Walk through the proof step-by-step, encouraging student participation and questions. 3. **Examples and Applications (30 minutes)** • **Worked examples**: Solve a few examples on the board, demonstrating how to apply Euler's theorem. • **Interactive problem-solving**: Have students work on problems in pairs or small groups, then discuss solutions as a class. • **Applications**: Discuss real-world applications in fields like economics (e.g., Cobb-Douglas production function), physics, and engineering. .

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://nptel.ac.in/courses/111/107/111107108/ https://youtu.be/btLWNJdHzSQ 3. Homework - Given some questions on Partial derivative to solve. Spend 5 minutes to wrap up and consolidate the learnings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 1.3	Course Name: Engineering Mathematics Topic: Partial differentiation	Course No.: BSC-101

Objectives	Students will understand the concept of asymptotes, both vertical and horizontal, in the context of differential calculus. They will be able to identify and analyze asymptotic behavior in functions.
Teaching Aids (if any)	a. ICT
Teaching Development	**1. Introduction:** (5 minutes) **A.** Review the definition of a limit and remind students of the behavior of a function as it approaches a specific point. **B.** Motivation: Discuss real-life situations where asymptotes might occur. For example, consider a population growth model where the population approaches a certain limit as time goes to infinity. 2. **Types of Asymptotes** (5 minutes) **Vertical Asymptotes, Horizontal and Oblique Asymptotes:** • Introduce the concept of vertical Horizontal and Oblique asymptotes. Explain that a vertical Horizontal and Oblique asymptote occurs when the function approaches infinity or negative infinity as the variable approaches a certain value. • Examples: Work through several examples of functions with vertical asymptotes. Emphasize how to identify the values causing the asymptote and how to determine the behavior of the function near those points. **3. Exercise**(20 minutes) • a. Give students additional problems to solve, focusing on functions with vertical, horizontal and oblique asymptotes. • b. Encourage them to discuss their approaches with each other.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.jyotinivas.org/pdf/e_content/mathematics/Study%20Material%20-%20radius%20of%20curvature.pdf 3. Homework - Given some questions on Oblique Asymptotes to solve. Spend 5 minutes to wrap up and consolidate the learning's.

Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 1.4	Course Name: Engineering Mathematics I Topic: Double Points	Course No.: BSC-101

Objectives	Students will be able to understand and identify double points in differential calculus, specifically focusing on the concept of double roots and inflection points.
Teaching Aids (if any)	a. ICT
Teaching Development	**Introduction**: (10 minutes) • Recap of Derivatives: Begin by revisiting the concept of derivatives. Remind students of the derivative as the rate of change of a function at a given point. • Critical Points: Review critical points and their significance in identifying points where the derivative is either zero or undefined. Definition of Double Points • Introduce the concept of double points. • Explain that a double point occurs when the first derivative is zero at a certain point, and the second derivative also equals zero at that same point. • Double Roots: Discuss the scenario when the function has a double root. Use examples to illustrate this concept. Emphasize the difference between a simple root and a double root. • Inflection Points: Move on to the concept of inflection points. Explain that an inflection point is a point on the graph where the curve changes concavity. A double point can also be an inflection point if the second derivative is zero at that point. • Graphical Representation: Use a graphing calculator or software to visually represent functions with double points. Show how the graph behaves differently at double points compared to single points. 1. Exercise (30 minutes) – -Do various problems on finding the double points of the curve. - Do various problems on finding the nature of double points of the given curve.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.jyotinivas.org/pdf/e_content/mathematics/Study%20Material%20-%20radius%20of%20curvature.pdf 3. Homework - Given some questions on double points of curves to solve. Spend 5 minutes to wrap up and consolidate the learning''s.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 1.6	Course Name: Engineering Mathematics Topic: Curvature of planes	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Curvature. b. To calculate the Radius of Curvature of the curve. c. Understand the curvature and radius of curvature along with their relevance with derivatives.
Teaching Aids (if any)	a. ICT
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - How fast a curve is changing direction at a given point? - How we design railway curves? - How we design rollercoaster curves? **2 Introduce the concept of Curvature and radius of curvature.** (5 minutes) - Talk about its applications in day to day life. - Introduce the formal concept of Curvature by Dr. Gajendra Purohit. - https://www.youtube.com/watch?v=qtgji5ws8LA - Highlight the important characteristics of the Curvature. - How to find the radius of curvature.. 2. Exercise (30 minutes) – -Do various problems on finding the curvature of the curve. - Do various problems on finding the radius of curvature of the given curve.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.jyotinivas.org/pdf/e_content/mathematics/Study%20Material%20-%20radius%20of%20curvature.pdf 3. Homework - Given some questions on Radius of Curvature to solve. Spend 5 minutes to wrap up and consolidate the learning’s.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 7	Course Name: Engineering Mathematics Topic:	Course No.: BSC-101

Objectives	By the end of the lesson, students should be able to: 1. Understand the basic concepts of curve tracing. 2. Identify and analyze different types of curves.
Teaching Aids (if any)	a. ICT
Teaching Development	**Introduction** (10 minutes): • Display different types of curves on the board (circle, parabola, hyperbola, etc.). o Ask students to identify the equations of these curves if possible. • Discussion: o Define curve tracing and explain its significance in mathematics. o Introduce the idea of parametric equations and how they are used in curve tracing. ● Discuss different types of curves and their general equations. ● Emphasize the importance of understanding the characteristics of each type of curve. ● Introduce parametric equations as a way to represent curves. ● Explain how parameters affect the shape and position of curves. Techniques for Curve Tracing (40 minutes): ● Discuss techniques such as finding critical points, analyzing asymptotes, and determining concavity. ● Demonstrate how to use these techniques with examples on the board.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : H.Arora, N.P. Bali https://www.youtube.com/embed/i6ZmA9EEzrI?autoplay=1&wmode=transparent&origin=https://in.video.search.yahoo.com&html5=1&enablejsap 3. Homework - Given some questions on trace and sketch the curve to solve. Spend 5 minutes to wrap up and consolidate the learning''s.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 8	Course Name: Engineering Mathematics Topic: Rolle's Theorem, Mean value Theorem	Course No.: BSC-101

Objectives	By the end of this lesson, students will be able to Understand and apply Rolle's Theorem and Lagrange's Mean Value Theorem to analyze functions and solve problems related to calculus.
Teaching Aids (if any)	a. ICT
Teaching Development	**Introduction** (5 minutes): • Begin by reviewing the definition of continuity and differentiability. • Discuss the Intermediate Value Theorem briefly. **Development** (15 minutes)**:** • Explain the geometric interpretation using graphs. • Work through an example problem on the whiteboard to illustrate the application of Rolle's Theorem. • Have students practice solving problems individually or in pairs. • Introduce Lagrange's Mean Value Theorem: • Discuss the conditions and implications of Lagrange's Mean Value Theorem. • Work through an example problem on the whiteboard to illustrate the application of Lagrange's Mean Value Theorem. **Application and Connection** (20 minutes): • Discuss real-world applications of Rolle's Theorem and Lagrange's Mean Value Theorem. • Emphasize the importance of these theorems in understanding the behavior of functions and solving real-world problems.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : H. Arora, N.P. Bali 3. Homework - Given some questions on Rolle's Theorem and Lagrange's Mean Value Theorem to solve. Spend 5 minutes to wrap up and consolidate the learning's.

Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 9	Course Name: Engineering Mathematics **Topic:** In-determinant forms	Course No.: BSC-101

Objectives	1. Students will understand the concept of Taylor series and Maclurian series and its application in representing functions as infinite series. 2. Students will learn how to find Taylor and Maclurian series expansions for simple functions. 3. Students will apply Taylor and Maclurian series to approximate functions.
Teaching Aids (if any)	a. ICT
Teaching Development	**Introduction** (5 minutes): • Begin with a brief review of power series and sequences. • Introduce the concept of Taylor series and Maclurian series by explaining that it is a way to represent functions as an infinite sum of terms. • Discuss the importance of Taylor series and Maclurian series in mathematics and its applications in various fields such as physics and engineering. Development (15 minutes): • Definition of Taylor Series and Maclurian Series: • Define the Taylor series for a function f(x) centered at a point c • Define the Maclurian series for a function f(x) centered at a point c • Provide examples of finding the Taylor series and Maclurian series expansion for simple functions such as sinx, cosx, e^x. • Emphasize the importance of derivatives at the center point *c* in the expansion. • Discuss the concept of convergence and the interval of convergence for a Taylor series. • Explain the role of the remainder term (Lagrange remainder) in estimating how well the series approximates the function. **Application and Connection** (20 minutes): • Show how Taylor series and Maclurian series can be used to approximate functions, especially when direct evaluation is challenging. • Discuss real-world applications where Taylor series and Maclurian series are commonly used. • Distribute worksheets with exercises on finding Taylor series and Maclurian series expansions for various functions. • Include problems that involve determining the interval of convergence and using Taylor series and Maclurian series for approximation. • Encourage students to work in pairs or small groups to solve the problems.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : H.Arora, N.P. Bali https://www.youtube.com/watch?v=Jk9xMY4mPH8 3. Homework - Given some questions on Taylor and Maclurian series to solve. Spend 5 minutes to wrap up and consolidate the learning''s.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 10	Course Name: Engineering Mathematics Topic: In-determinant forms	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of indeterminate forms. b. Using the concept of limits and L'' Hospital Rule to solve indeterminate forms.
Teaching Aids (if any)	a. ICT b. Chalk & Talk
Teaching Development	1. **Introduction** (5 minutes) • When we have to find the limits like $0/0, 0*\infty, \infty*\infty$ forms, we use L'' Hospital Rule • Different above forms of limits are known as indeterminate forms. 2. **Development** (5 minutes) • Introduce the concept of indeterminate forms • Solve the indeterminate forms using L''Hospital Rule. 3. Exercise (30 minutes) – -Do various problems on solving indeterminate forms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://nptel.ac.in/courses/111105121 3. Homework Given some questions on limits and indeterminate forms to solve. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 11	**Course Name: Engineering Mathematics** **Topic:** Taylor series in two variables	**Course No.: BSC-101**

Objectives	At the end of the lesson the student shall be able to: 1. Understand the concept of a Taylor series in two variables. 2. Learn to derive and use the Taylor series expansion for functions of two variables. 3. Apply the Taylor series to approximate functions and solve practical problems.
Teaching Aids (if any)	a. ICT b. Chalk & Talk
Teaching Development	1. **Introduction** (5 minutes) 1. **Begin with a quick review** of the Taylor series in one variable. 2. **Introduce the concept** of functions of two variables, explaining how they differ from single-variable functions. 3. **State the goal** of the lesson: to extend the Taylor series concept to functions of two variables. 1. **Derivation of the Taylor Series in Two Variables (15 minutes):** o Present the formula for the Taylor series expansion in two variables: o Explain each term and its significance in the series. o Use graphical representations to visualize the concept of approximation. 2. **Examples and Applications (20 minutes):** o Work through a couple of examples, starting with simpler functions and progressing to more complex ones. o Show how to find the partial derivatives and higher-order derivatives needed for the expansion. o Demonstrate the application of the Taylor series to approximate a given function at a specific point. .
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://nptel.ac.in/courses/111105121

	https://www.youtube.com/watch?v=9H0wlv0lQl8 3. Homework Given some questions on limits and indeterminate forms to solve. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 12	**Course Name: Engineering Mathematics** **Topic:** Maxima and Minima of functions of two variables	**Course No.: BSC-101**

Objectives	At the end of articulate, Students will able to • Understand the concept of maxima and minima for a function in two variables. • Identify and analyze extreme values of the curve.
Teaching Aids (if any)	a. ICT b. Chalk & Talk
Teaching Development	**1. Introduction:** (20 minutes) a. Review the definition of neighborhood of a point in a set. b. Discuss the necessary and sufficient conditions for extreme values. **2. Development:** (50 minutes) a. Find the Maxima and Minima of the function. b. Examine the function for extreme values. **3. Exercise:** a. Give students additional problems to solve, focusing on functions with maxima and minima. b. Encourage them to discuss their approaches with each other.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading http://digimat.in/nptel/courses/video/111105121/L17.html 3. Homework Given some questions on Maxima and Minima to solve. Spend 5 minutes to wrap up and consolidate the learning''s.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 13	Course Name: Engineering Mathematics Topic: Lagrange's Multipliers Method	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Lagrange's Multipliers for conditional extremum value of the function. b. Using Hessian Matrix test to the maxima and minima point of the function.
Teaching Aids (if any)	a. ICT b. Chalk & Talk
Teaching Development	1. **Introduction** (5 minutes) • What is the other method to calculate maxima and minima of the function? • Lagrange's Multipliers Method: It a technique for finding a maximum or minimum of a function f(x,y,z)subject to a constraint (also called side condition) of the form $f(x, y, z) = 0$. 2. Development (10 minutes) • Lagrange's multipliers method of finding extreme values of the function. • Solve various problems on different functions for finding maxima and minima value. 3. Exercise (25 minutes) – Do various problems on solving different functions for finding extreme values.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.youtube.com/watch?v=xjUcaH6dCN0 3. Homework Given some questions on lagrange's method of multipliers to solve. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 14	Course Name: Engineering Mathematics **Topic:** Definite integrals with important properties	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Understand the concept of definite integrals. 2. Identify and apply important properties of definite integrals. 3. Solve problems involving definite integrals using these properties.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What is an integral?
	  ○ What are the differences between definite and indefinite integrals?
	• Introduce Concepts:
	  ○ Briefly explain definite integrals and their importance in calculus.:
	
	Development (10 minutes)
	
	• **Detailed Explanation of Definite Integrals:**
	  ○ Define definite integrals.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: YouTube: Understanding Definite Integrals
	• **Properties of Definite Integrals:**
	  ○ Linearity
	  ○ Additivity
	  ○ Reversal of Limits
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: YouTube: Properties of Definite Integrals
	
	Exercise (25 minutes)
	
	• Solve various problems using the properties of definite integrals.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Video Solution Examples:
	  ○ YouTube: Definite Integral Examples
	
	  ○ YouTube: Definite Integrals Introduction

	○
Closure	**Closure** • Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Definite Integrals ○ MIT OpenCourseWare: Calculus
Evaluation	**Evaluation** • Reflective Questions (What Why Who?): ○ What is a definite integral and why is it important? ○ How do the properties of definite integrals help in solving problems? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework ○ Assign problems on applying properties of definite integrals to different functions. Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 15	Course Name: Engineering Mathematics **Topic:** Differentiation under the integral sign	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Understand the concept of differentiation under the integral sign. 2. Apply this technique to solve integrals that are difficult to evaluate otherwise.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What are some techniques you use to evaluate integrals?
	  ○ Have you heard of Feynman's technique?
	• Introduce Concepts:
	  ○ Briefly explain the concept of differentiation under the integral sign and its historical context.
	
	Development (10 minutes)
	
	• **Detailed Explanation:**
	  ○ Define differentiation under the integral sign.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: YouTube: Understanding Differentiation Under the Integral Sign
	• **Application of the Technique:**
	  ○ Provide step-by-step solution to example problems.
	  ○ Video Resource: YouTube: Differentiation Under the Integral Sign Examples
	
	Exercise (25 minutes)
	
	• Solve various problems using the differentiation under the integral sign technique.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Video Solution Examples:
	  ○ YouTube: More Examples
	
	  ○ YouTube: Differentiation Under the Integral Sign

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Integration Techniques
	  ○ MIT OpenCourseWare: Calculus

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is differentiation under the integral sign and why is it useful?
	  ○ How can you apply this technique to solve complex integrals?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework
	  ○ Assign problems on applying differentiation under the integral sign to different integrals.
	
	Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 16	Course Name: Engineering Mathematics Topic: Gamma Function with Problems	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Understand the definition and properties of the Gamma function. 2. Apply the Gamma function to solve related problems.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What is a factorial?
	  ○ Have you encountered the Gamma function before?
	• Introduce Concepts:
	  ○ Briefly explain the Gamma function and its relation to factorials.
	
	Development (10 minutes)
	
	• **Detailed Explanation:**
	  ○ Define the Gamma function.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: YouTube: Understanding the Gamma Function
	• **Properties and Applications:**
	  ○ Discuss important properties of the Gamma function.
	  ○ Solve example problems involving the Gamma function.
	  ○ Video Resource:
	  ○ YouTube: Gamma Function Properties and Examples
	
	Exercise (25 minutes)
	
	• Solve various problems using the Gamma function.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	
	Video Solution Examples
	
	• YouTube: Gamma Function Problem Solving
	• YouTube: Introduction to Gamma Function

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Special Functions
	  ○ MIT OpenCourseWare: Advanced Calculus

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the Gamma function and why is it important?
	  ○ How can you apply the Gamma function to solve problems?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework
	  ○ Assign problems on applying the Gamma function to different scenarios.
	  ○ Spend 5 minutes to wrap up and consolidate.

Lesson Plan No. 17	Course Name: Engineering Mathematics Topic: Beta Function with problems	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Understand the definition and properties of the Beta function. 2. Apply the Beta function to solve related problems.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ Have you encountered the Beta function before?
	• Introduce Concepts:
	  ○ Briefly explain the Beta function and its relation to the Gamma function
	
	Development (10 minutes)
	
	• **Detailed Explanation:**
	  ○ Define the Beta function.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: YouTube: Understanding the Beta Function
	• **Properties and Applications:**
	  ○ Discuss important properties of the Beta function.
	  ○ Solve example problems involving the Beta function.
	
	• Video Resource:
	• YouTube: Beta Function Properties and Examples
	• YouTube: Introduction to Beta Function
	
	Exercise (25 minutes)
	
	• Solve various problems using the Beta function.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Video Solution Examples: YouTube: Beta Function Problem Solving

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions.

	• Provide additional resources for further reading:
	  ○ Khan Academy: Special Functions
	  ○ MIT OpenCourseWare: Advanced Calculus
	  ○

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the Beta function and why is it important?
	  ○ How can you apply the Beta function to solve problems?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework
	  ○ Assign problems on applying the Beta function to different scenarios.
	  ○ Spend 5 minutes to wrap up and consolidate.

Lesson Plan No. 18	**Course Name: Engineering Mathematics** **Topic:** Applications of definite integrals to find length, area, volume and surface area of revolutions	**Course No.: BSC-101**

Objectives	At the end of the lesson, the student shall be able to: 1. Use definite integrals to find the length of curves. 2. Calculate areas under curves using definite integrals. 3. Determine the volume and surface area of solids of revolution.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What are some real-life applications of integrals?
	  ○ How do you find the area under a curve?
	• Introduce Concepts:
	  ○ Briefly explain the applications of definite integrals.
	
	Development (10 minutes)
	
	• **Length of Curves:**
	  ○ Define the formula for finding the length of a curve using integrals.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: YouTube: Length of a Curve
	• **Area Under Curves:**
	  ○ Define and calculate the area under a curve using definite integrals.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: YouTube: Area Under a Curve
	• **Volume and Surface Area of Solids of Revolution:**
	  ○ Explain the methods of disk, washer, and shell for finding volume.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: YouTube: Volume of Solids of Revolution
	
	Exercise (25 minutes)
	
	• Solve various problems using definite integrals for length, area, volume, and surface area.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:

	○ Video Solution Examples: ○ YouTube: Definite Integral Applications ○ YouTube: Applications of Definite Integrals
Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Applications of Definite Integrals ○ MIT OpenCourseWare: Calculus
Evaluation	• Reflective Questions (What Why Who?): ○ How can definite integrals be used to find the length of a curve? ○ How do you calculate the volume of a solid of revolution? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework ○ Assign problems on applying definite integrals to different scenarios. ○ Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 19	**Course Name: Engineering Mathematics** **Topic:** Transformation of coordinates	**Course No.: BSC-101**

Objectives	At the end of the lesson, the student shall be able to: 1. Understand different coordinate systems. 2. Transform coordinates from one system to another. 3. Apply transformations to solve problems in geometry and physics.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What are the different types of coordinate systems you know?
	• Introduce Concepts:
	  ○ Briefly explain the importance of coordinate transformations.
	
	Development (10 minutes)
	
	• **Different Coordinate Systems:**
	  ○ Cartesian, polar, cylindrical, and spherical coordinates.
	  ○ Provide examples and illustrations.
	  ○ Video Resource: YouTube: Types of Coordinate Systems
	• **Transformation Techniques:**
	  ○ Explain how to transform coordinates from one system to another.
	  ○ Provide step-by-step examples.
	  ○ Video Resource: YouTube: Coordinate Transformation
	
	Exercise (25 minutes)
	
	• Solve various problems involving coordinate transformations.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Video Solution Examples: YouTube: Coordinate Transformation Examples

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading:

	○ Khan Academy: Coordinate Systems • MIT OpenCourseWare: Coordinate Transformations: ○ YouTube: Coordinate Systems
Evaluation	• Reflective Questions (What Why Who?): ○ How can you transform Cartesian coordinates to polar coordinates? ○ What are the applications of coordinate transformations in physics? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework ○ Assign problems on transforming coordinates from one system to another. ○ Spend 5 minutes to wrap up and consolidate.

Lesson Plan No. 20	**Course Name: Engineering Mathematics** **Topic:** Double and triple integrals with simple problems	**Course No.: BSC-101**

Objectives	At the end of the lesson, the student shall be able to: 1. Understand the concept of double and triple integrals. 2. Apply these integrals to solve problems involving volume and mass.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What is an integral?
	  ○ Have you encountered double or triple integrals before?
	• Introduce Concepts:
	  ○ Briefly explain the concept of double and triple integrals and their applications.
	
	Development (10 minutes)
	
	• **Double Integrals:**
	  ○ Define and explain the double integral.
	  ○ Provide examples to illustrate the concept.
	• **Triple Integrals:**
	  ○ Define and explain the triple integral.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: YouTube: Understanding Triple Integrals
	
	Exercise (25 minutes)
	
	• Solve various problems using double and triple integrals.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	
	Video Solution Example
	YouTube: Double and Triple Integral Examples
	YouTube: Understanding Double Integrals

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading:

	○ Khan Academy: Multivariable Calculus ○ MIT OpenCourseWare: Multivariable Calculus ○ YouTube: Double and Triple Integrals
Evaluation	• Reflective Questions (What Why Who?): ○ What are double and triple integrals and why are they important? ○ How do you apply these integrals to solve problems in volume and mass? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework ○ Assign problems on applying double and triple integrals to different scenarios. ○ Spend 5 minutes to wrap up and consolidate.

Lesson Plan No. 21	Course Name: Engineering Mathematics **Topic:** Definite integrals with important properties	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Define and explain the concept of definite integrals. 2. Understand and apply the properties of definite integrals. 3. Solve problems involving definite integrals.
Teaching Aids (if any)	• ICT tools, • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What do you understand by integration?
	  ○ Can you list some applications of integrals in real life?
	• Introduce Concepts:
	  ○ Briefly introduce the concept of definite integrals.
	  ○ Explain the importance of definite integrals in mathematics and its applications.
	
	Development (10 minutes)
	
	• **Detailed Explanation of Definite Integrals:**
	  ○ Define definite integrals.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Understanding Definite Integrals
	• **Properties of Definite Integrals:**
	  ○ Linearity of integrals.
	  ○ Additivity of integrals over adjacent intervals.
	  ○ Relationship between definite and indefinite integrals.
	  ○ Video Resource: Properties of Definite Integrals
	
	Exercise (25 minutes)
	
	• Solve various problems involving definite integrals.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems: Problems from the textbook and additional worksheets.
	
	Video Solution Examples: Definite Integral Examples

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading:

	• Khan Academy: Definite Integrals

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is a definite integral and why is it important?
	  ○ How do the properties of definite integrals help in solving problems?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 22	Course Name: Engineering Mathematics Topic: Matrices	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Define and explain the concept of matrices. 2. Understand different types of matrices. 3. Perform basic operations on matrices.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• Questions to Engage Students:
	  ○ What is a matrix?
	  ○ Can you list some applications of matrices in real life?
	• Introduce Concepts:
	  ○ Briefly introduce the concept of matrices.
	  ○ Explain the importance of matrices in mathematics and its applications.
	
	Development (10 minutes)
	
	• **Detailed Explanation of Matrices:**
	  ○ Define matrices.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Understanding Matrices
	• **Types of Matrices:**
	  ○ Row matrix, column matrix, square matrix, diagonal matrix, scalar matrix, identity matrix, zero matrix.
	  ○ Video Resource: Types of Matrices
	
	Exercise (25 minutes)
	
	• Solve various problems involving matrices.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems: Problems from the textbook and additional worksheets.
	• Video Solution Examples: Matrix Examples

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: Khan Academy:

	Matrices

Evaluation	• Reflective Questions (What, Why, Who?):
	  ○ What is a matrix and why is it important?
	  ○ What are the different types of matrices?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 23	Course Name: Engineering Mathematics Topic: Matrices	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain vector addition and scalar multiplication. • Perform vector addition and scalar multiplication. • Apply these operations to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What are vectors?
	  ▪ Can you give examples of vectors in physics or engineering?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce vector addition and scalar multiplication.
	  ▪ Explain the importance of these operations in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Vector Addition:**
	  ▪ Define vector addition.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: Vector Addition Explained
	  ○ **Detailed Explanation of Scalar Multiplication:**
	  ▪ Define scalar multiplication.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: Scalar Multiplication Explained
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving vector addition and scalar multiplication.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Perform vector addition and scalar multiplication with given vectors.
	  ○ Video Solution Examples: YouTube: Vector Operations Examples

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Vectors

	○ MIT OpenCourseWare: Linear Algebra
Evaluation	• Reflective Questions (What Why Who?): ○ What is vector addition and why is it important? ○ What is scalar multiplication and why is it important? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 24	Course Name: Engineering Mathematics Topic: Matrix multiplication	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of matrix multiplication. • Perform matrix multiplication with given matrices. • Apply matrix multiplication to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What are matrices?
	  ▪ Can you give examples of matrices in real-life applications?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of matrix multiplication.
	  ▪ Explain the importance of matrix multiplication in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Matrix Multiplication:**
	  ▪ Define matrix multiplication.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: How to Multiply Matrices
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving matrix multiplication.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Perform matrix multiplication with given matrices.
	Video Solution Examples: YouTube: Matrix Multiplication Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Matrix Multiplication
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is matrix multiplication and why is it important?
	  ○ How do you perform matrix multiplication with given matrices?
	• Allow students to discuss and reflect on these questions.
	Spend 5 minutes to evaluate students' understanding through a short quiz

	or discussion

Lesson Plan No. 25	Course Name: Engineering Mathematics Topic: linear systems of equations	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of linear systems of equations. • Solve linear systems of equations using various methods. • Apply these methods to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What are linear equations?
	  ▪ Can you give examples of linear systems in real-life applications?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of linear systems of equations.
	  ▪ Explain the importance of solving linear systems in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Solving Linear Systems:**
	  ▪ Define linear systems of equations.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: Solving Linear Systems of Equations
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving linear systems of equations.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Solve given linear systems using different methods (e.g., substitution, elimination).
	  ○ Video Solution Examples: YouTube: Linear Systems Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Equations
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is a linear system of equations and why is it important?
	  ○ How do you solve linear systems using different methods?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 26	Course Name: Engineering Mathematics Topic: Linear Independence	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of linear independence. • Determine linear independence for given sets of vectors. • Apply the concept of linear independence to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What are vectors?
	  ▪ Can you give examples of linearly independent vectors?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of linear independence.
	  ▪ Explain the importance of understanding linear independence in linear algebra.
	  ○ Video Introduction:
	  ▪ YouTube: Linear Independence
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Linear Independence:**
	  ▪ Define linear independence.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: Understanding Linear Independence
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving linear independence.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Determine the linear independence of given sets of vectors.
	  ○ Video Solution Examples: YouTube: Linear Independence Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Matrix Rank
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the rank of a matrix and why is it important?
	  ○ How do you determine the rank of given matrices?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 27	Course Name: Engineering Mathematics Topic: Rank of a matrix	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of the rank of a matrix. • Determine the rank of given matrices. • Apply the concept of matrix rank to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What is a matrix?
	  ▪ Can you give examples of matrices in real-life applications?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of the rank of a matrix.
	  ▪ Explain the importance of understanding matrix rank in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Rank of a Matrix:**
	  ▪ Define the rank of a matrix.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: YouTube: Understanding Matrix Rank
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving the rank of a matrix.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Determine the rank of given matrices.
	Video Solution Examples: YouTube: Matrix Rank Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Matrix Rank
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the rank of a matrix and why is it important?
	  ○ How do you determine the rank of given matrices?
	• Allow students to discuss and reflect on these questions.

	Spend 5 minutes to evaluate students' understanding through a short quiz or discussion

Lesson Plan No. 27	Course Name: Engineering Mathematics Topic: Rank of a matrix	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of determinants. • Apply Cramer's Rule to solve linear systems of equations. • Use determinants and Cramer's Rule to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What is a determinant?
	  ▪ Can you give examples of where determinants are used?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of determinants and Cramer's Rule.
	  ▪ Explain the importance of understanding these concepts in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Determinants:**
	  ▪ Define determinants.
	  ▪ Provide examples to illustrate the concept.
	  ○ **Detailed Explanation of Cramer's Rule:**
	  ▪ Define Cramer's Rule.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: Applying Cramer's Rule
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving determinants and Cramer's Rule.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Use Cramer's Rule to solve given linear systems of equations.
	  ○ Video Solution Examples: Cramer's Rule Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Determinants and Cramer's Rule
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What are determinants and why are they important?
	  ○ How do you apply Cramer-'s Rule to solve linear systems?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 29	Course Name: Engineering Mathematics Topic: Inverse of a matrix	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the concept of the inverse of a matrix. • Find the inverse of given matrices. • Apply the concept of matrix inversion to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What is a matrix?
	  ▪ Can you give examples of where the inverse of a matrix is used?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the concept of the inverse of a matrix.
	  ▪ Explain the importance of understanding matrix inversion in linear algebra.
	  ○ Video Introduction:
	  ▪ Inverse of a Matrix
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Matrix Inversion:**
	  ▪ Define the inverse of a matrix.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: Understanding Matrix Inversion
	• **Exercise (25 minutes)**
	  ○ Solve various problems involving the inverse of a matrix.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Find the inverse of given matrices.
	  ○ Video Solution Examples: Matrix Inversion Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Matrix Inversion
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the inverse of a matrix and why is it important?
	  ○ How do you find the inverse of given matrices?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.

Lesson Plan No. 30	Course Name: Engineering Mathematics Topic: Gauss elimination	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the Gauss elimination method. • Apply the Gauss elimination method to solve linear systems of equations. • Use the Gauss elimination method to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What is a linear system of equations?
	  ▪ Can you give examples of where Gauss elimination is used?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the Gauss elimination method.
	  ▪ Explain the importance of understanding this method in linear algebra.
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Gauss Elimination:**
	  ▪ Define the Gauss elimination method.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: Understanding Gauss Elimination
	• **Exercise (25 minutes)**
	  ○ Solve various problems using the Gauss elimination method.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Apply the Gauss elimination method to solve given linear systems.
	  ○ Video Solution Examples: Gauss Elimination Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Gauss Elimination
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):

	○ What is the Gauss elimination method and why is it important? ○ How do you apply the Gauss elimination method to solve linear systems? • Allow students to discuss and reflect on these questions. Spend 5 minutes to evaluate students' understanding through a short quiz or discussion

Lesson Plan No. 30	Course Name: Engineering Mathematics Topic: Gauss Jordan elimination	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Define and explain the Gauss-Jordan elimination method. • Apply the Gauss-Jordan elimination method to solve linear systems of equations. • Use the Gauss-Jordan elimination method to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	• **Introduction (5 minutes)**
	  ○ Questions to Engage Students:
	  ▪ What is a linear system of equations?
	  ▪ Can you give examples of where Gauss-Jordan elimination is used?
	  ○ Introduce Concepts:
	  ▪ Briefly introduce the Gauss-Jordan elimination method.
	  ▪ Explain the importance of understanding this method in linear algebra.
	  ○ Video Introduction:
	  ▪ Gauss-Jordan Elimination
	• **Development (10 minutes)**
	  ○ **Detailed Explanation of Gauss-Jordan Elimination:**
	  ▪ Define the Gauss-Jordan elimination method.
	  ▪ Provide examples to illustrate the concept.
	  ▪ Video Resource: Understanding Gauss-Jordan Elimination
	• **Exercise (25 minutes)**
	  ○ Solve various problems using the Gauss-Jordan elimination method.
	  ○ Group activity: Students will work in pairs to solve given exercises and present their solutions.
	  ○ Additional Practice Problems:
	  ▪ Apply the Gauss-Jordan elimination method to solve given linear systems.
	  ○ Video Solution Examples: Gauss-Jordan Elimination Examples

Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading:

	○ Khan Academy: Gauss-Jordan Elimination MIT OpenCourseWare: Linear Algebra
Evaluation	• Reflective Questions (What Why Who?): ○ What is the Gauss-Jordan elimination method and why is it important? ○ How do you apply the Gauss-Jordan elimination method to solve linear systems? • Allow students to discuss and reflect on these questions. Spend 5 minutes to evaluate students' understanding through a short quiz or discussion

Lesson Plan No. 32	Course Name: Engineering Mathematics Topic: Linear dependence of vectors	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Vectors. b. Analyze real world scenarios to recognize when use of vectors, matrices, or linear systems is appropriate. c. Recognize and use basic properties of subspaces and vector spaces. d. Determine whether or not particular subsets of a vector space are subspaces.
Teaching Aids (if any)	a. ICT b. Use of Near pod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - Quantum Mechanics is entirely based on which topic? - In electromagnetic field theory which is a fundamental course for communication engineering? - For exchanging secret information we use which tool? - What is important for computer graphics? - **Introduce the concept of Vector Spaces.** - Talk about its applications in day to day life. - Introduce the formal concept of vector Spaces by MIT - https://ocw.mit.edu/courses/physics/8-05-quantum-physics-ii-fall-2013/video-lectures/lecture-5-linear-algebra-vector-spaces-and-operators/ Real life example of vector Spaces. - https://www.youtube.com/watch?v=dPbx8eW2X24 - Highlight the important characteristics of the Vector Spaces. - Introduce the concept of Subspace of a Vector Space. - Highlight the important characteristics of Subspaces. 2. **Development** (5 minutes) a. Vector Spaces. - Introduce the concept of vector Spaces. Please consult this video https://nptel.ac.in/content/storage2/111/106/111106135/MP4/mod01lec01.mp4 b. Subspaces of Vector spaces. -Introduce the concept of Subspace of a Vector Space. https://nptel.ac.in/content/storage2/111/106/111106135/MP4/mod01lec03.mp4 3. Exercise (30 minutes) – -Do various problems on Linear dependence of vectors.

	- Do various problems on finding Linear dependence of vectors.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.youtube.com/watch?v=xjUcaH6dCN0 3. Homework Given some questions on Linear dependence of vectors to solve. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 33	Course Name: Engineering Mathematics Topic: Basis and dimension	Course No.: BSC-101

Objectives	• Articulate the concept of a basis in a vector space. • Determine the basis of a given vector space. • Understand the definition and importance of the dimension of a vector space. • Apply the concepts of basis and dimension to solve various problems in linear algebra.
Teaching Aids (if any)	• ICT (Interactive Computing Technology) • Whiteboard and markers
Teaching Development	1. **Questions to Engage Students:** o What is a vector space? Can you name a few examples? o How do you determine if a set of vectors is linearly independent? 2. **Introduce the Concept of Basis:** o Define what a basis of a vector space is. o Explain the significance of having a basis. 3. **Introduce the Concept of Dimension:** o Define the dimension of a vector space. o Relate the dimension to the number of vectors in a basis. **Development (20 minutes)** 1. **Basis:** o Explain the formal definition of a basis. o Show examples of finding a basis for simple vector spaces (e.g., R. 2. **Dimension:** o Explain how the dimension is the number of vectors in any basis for the vector space. o Discuss the dimension of various vector spaces. 3. **Examples and Problems:** o Work through problems to find the basis of given sets of vectors. o Demonstrate how to check if a set of vectors forms a basis. o Show examples where students find the dimension of various vector spaces. **Exercise (30 minutes)**

	• Provide various problems on finding the basis and dimension of vector spaces.
	• Encourage group work to solve more complex problems.
	• Walk around and assist students as needed.
	• Example problems:
	  ○ Determine if the set {(1,0),(0,1)}, {(1, 0), (0, 1)}{(1,0),(0,1)} is a basis for R.
	  ○ Find the dimension of the vector space spanned by {(1,2,3),(4,5,6),(7,8,9)}, {(1, 2, 3), (4, 5, 6), (7, 8, 9) }{(1,2,3),(4,5,6),(7,8,9)}.

Closure	• Summarize the Lesson Learning Outcomes.
	  ○ Review the definition of basis and dimension.
	  ○ Confirm students' understanding with a quick recap.
	• Suggested Reading:
	  ○ Linear Algebra by Gilbert Strang
	  ○ Online resources like Khan Academy's Linear Algebra course
	
	Homework
	
	• Assign problems on finding the basis and dimension of given vector spaces.
	• Spend 5 minutes to wrap up and consolidate the learnings.

Evaluation	• Reflective Questions:
	  ○ What is a basis, and why is it important?
	  ○ How do you determine the dimension of a vector space?
	• Allow students to answer and discuss.
	• Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 33	Course Name: Engineering Mathematics Topic: Basis and dimension	Course No.: BSC-101

Objectives	At the end of the lesson the student shall be able to: • Understand the concept of Linear Transformations. • Identify and verify linear transformations. • Apply the properties of linear transformations to solve various problems.
Teaching Aids (if any)	ICT (Projector, Computer, etc.)
Teaching Development	**Introduction (5 minutes)** 1. Start with a question: "Can anyone define what a transformation in mathematics is?" 2. Discuss some common transformations (e.g., rotations, translations). 3. Introduce the concept of Linear Transformations and their importance. 4. Show real-life applications of linear transformations in engineering and computer graphics. 5. Introduce formal definitions and concepts related to Linear Transformations. **Development (10 minutes)** 1. **Concept of Linear Transformation**: o Define Linear Transformation. o Explain the properties of linear transformations (Additivity and Homogeneity). o Provide examples of functions that are linear transformations. 2. **Verification of Linear Transformations**: o Discuss how to verify if a given transformation is linear. o Solve examples to illustrate the verification process. **Exercise (25 minutes)** 1. Provide problems for students to practice verifying linear transformations.

	2. Solve problems involving the computation of linear transformations. 3. Work on examples involving matrices and transformations in coordinate spaces. 4. Discuss and solve problems involving the kernel and image of a linear transformation.
Closure	1. Summarize the lesson's key points. 2. Ask students to articulate the main characteristics of linear transformations. 3. Reinforce the applications and importance of understanding linear transformations in engineering and technology. **Suggested Reading** • NPTEL Course on Linear Algebra (https://nptel.ac.in/courses/111/106/111106051/) • Textbook: "Linear Algebra and Its Applications" by Gilbert Strang. **Homework** 1. Assign problems on verifying and applying linear transformations. 2. Ask students to read the next section in the textbook on Matrix Representations of Linear Transformations. 1.
Evaluation	1. Reflective Questions: What is a linear transformation? Why are linear transformations important in engineering? 2. Allow students to answer and discuss. 3. Spend 5 minutes to evaluate student understanding through a quick quiz or problem-solving session.

Lesson Plan No. 35	Course Name: Engineering Mathematics Topic: Range and kernel of a linear map	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: 1. Define and explain the concepts of range and kernel in the context of linear maps. 2. Determine the range and kernel for given linear transformations. 3. Apply the concepts of range and kernel to solve related problems in linear algebra.
Teaching Aids (if any)	• ICT tools • Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	
	• **Questions to Engage Students:**
	  ○ What is a linear map?
	  ○ Can you give examples of linear transformations?
	• **Introduce Concepts:**
	  ○ Briefly introduce the concept of a linear map.
	  ○ Explain the importance of understanding the range and kernel in linear algebra.
	• **Video Introduction:**
	  ○ Introduce the formal concepts with the help of a YouTube video: Introduction to Linear Maps
	
	Development (10 minutes)
	
	• **Detailed Explanation of Range:**
	  ○ Define the range of a linear map.
	  ○ Provide examples to illustrate the concept.
	  ○ **Video Resource:** Range of a Linear Transformation
	• **Detailed Explanation of Kernel:**
	  ○ Define the kernel of a linear map.
	  ○ Provide examples to illustrate the concept.
	  ○ **Video Resource:** Kernel of a Linear Transformation
	• **Relationship between Range, Kernel, and Dimension Theorem:**
	  ○ Discuss the Rank-Nullity Theorem.
	  ○ Provide examples and solve related problems.
	  ○ **Video Resource:** Rank-Nullity Theorem
	
	Exercise (25 minutes)
	
	• Solve various problems to find the range and kernel of given linear maps.
	• Group activity: Students will work in pairs to solve given exercises and

	present their solutions.
	• **Additional Practice Problems:**
	  ○ Find the range and kernel of given matrices and linear transformations.
	  ○ **Video Solution Examples:** Range and Kernel Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Algebra
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What, Why, Who?):
	  ○ What is the range of a linear map, and why is it important?
	  ○ What is the kernel of a linear map, and why is it important?
	  ○ How do the range and kernel relate to the dimension theorem?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	Homework
	• Assign problems on finding the range and kernel of different linear maps.
	• Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 36	**Course Name: Engineering Mathematics** **Topic:** Rank and nullity of linear transformation	**Course No.: BSC-101**

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concepts of rank and nullity. • Determine the rank and nullity for given matrices and linear transformations. • Apply the concepts of rank and nullity to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What do you understand by the rank of a matrix?
	  ○ Can you define nullity in the context of linear algebra?
	• Introduce Concepts:
	  ○ Briefly introduce the concepts of rank and nullity.
	  ○ Explain the importance of understanding rank and nullity in linear algebra.
	• Video Introduction:
	  ○ Introduce the formal concepts with the help of a YouTube video: Introduction to Rank and Nullity
	https://archive.nptel.ac.in/courses/111/106/111106051/
	Development (10 minutes)
	• Detailed Explanation of Rank:
	  ○ Define the rank of a matrix.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Rank of a Matrix
	• Detailed Explanation of Nullity:
	  ○ Define the nullity of a matrix.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Nullity of a Matrix
	• Relationship between Rank, Nullity, and the Dimension Theorem:
	  ○ Discuss the Rank-Nullity Theorem.

	○ Provide examples and solve related problems. ○ Video Resource: Rank-Nullity Theorem **Exercise (25 minutes)** • Solve various problems to find the rank and nullity of given matrices. • Group activity: Students will work in pairs to solve given exercises and present their solutions. • Additional Practice Problems: ○ Find the rank and nullity of given matrices and linear transformations. ○ Video Solution Examples: Rank and Nullity Examples
Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Linear Algebra ○ MIT OpenCourseWare: Linear Algebra
Evaluation	• Reflective Questions (What Why Who?): ○ What is the rank of a matrix and why is it important? ○ What is the nullity of a matrix and why is it important? ○ How do the rank and nullity relate to the dimension theorem? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework: Assign problems on finding the rank and nullity of different matrices. Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 37	Course Name: Engineering Mathematics Topic: Inverse of a Linear Transformation	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concept of the inverse of a linear transformation. • Determine the inverse of given linear transformations. • Apply the concept of inverse to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What is a linear transformation?
	  ○ Can a linear transformation always be inverted?
	• Introduce Concepts:
	  ○ Briefly introduce the concept of the inverse of a linear transformation.
	  ○ Explain the importance of understanding inverses in linear algebra.
	Development (10 minutes)
	• Detailed Explanation of Inverse:
	  ○ Define the inverse of a linear transformation.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Inverse of Linear Transformations
	• Steps to Find the Inverse:
	  ○ Discuss the method to find the inverse of a linear transformation.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: Finding Inverse of Linear Transformations
	Exercise (25 minutes)
	• Solve various problems to find the inverse of given linear transformations.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.

	• Additional Practice Problems:
	  ○ Find the inverse of given linear transformations and verify the results.
	  ○ Video Solution Examples: Inverse Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Algebra
	  ○ MIT OpenCourseWare: Linear Algebra https://archive.nptel.ac.in/courses/111/106/111106051/

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is the inverse of a linear transformation and why is it important?
	  ○ How do you determine if a linear transformation is invertible?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework: Assign problems on finding the inverse of different linear transformations.
	
	Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 36	Course Name: Engineering Mathematics Topic: Rank and nullity theorem	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concepts of rank and nullity. • Determine the rank and nullity for given matrices and linear transformations. • Apply the concepts of rank and nullity to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What do you understand by the rank of a matrix?
	  ○ Can you define nullity in the context of linear algebra?
	• Introduce Concepts:
	  ○ Briefly introduce the concepts of rank and nullity.
	  ○ Explain the importance of understanding rank and nullity in linear algebra.
	• Video Introduction:
	  ○ Introduce the formal concepts with the help of a YouTube video: Introduction to Rank and Nullity
	https://archive.nptel.ac.in/courses/111/106/111106051/
	Development (10 minutes)
	• Detailed Explanation of Rank:
	  ○ Define the rank of a matrix.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Rank of a Matrix
	• Detailed Explanation of Nullity:
	  ○ Define the nullity of a matrix.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Nullity of a Matrix
	• Relationship between Rank, Nullity, and the Dimension Theorem:
	  ○ Discuss the Rank-Nullity Theorem.
	  ○ Provide examples and solve related problems.

	○ Video Resource: Rank-Nullity Theorem **Exercise (25 minutes)** • Solve various problems to find the rank and nullity of given matrices. • Group activity: Students will work in pairs to solve given exercises and present their solutions. • Additional Practice Problems: ○ Find the rank and nullity of given matrices and linear transformations. ○ Video Solution Examples: Rank and Nullity Examples
Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Linear Algebra ○ MIT OpenCourseWare: Linear Algebra
Evaluation	• Reflective Questions (What Why Who?): ○ What is the rank of a matrix and why is it important? ○ What is the nullity of a matrix and why is it important? ○ How do the rank and nullity relate to the dimension theorem? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework: Assign problems on finding the rank and nullity of different matrices. Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 39	Course Name: Engineering Mathematics Topic: composition of linear maps	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the composition of linear maps. • Determine the result of composing given linear maps. • Apply the concept of composition to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What is a linear map?
	  ○ How can we combine two linear maps?
	• Introduce Concepts:
	  ○ Briefly introduce the concept of composition of linear maps.
	  ○ Explain the importance of understanding composition in linear algebra.
	Development (10 minutes)
	• Detailed Explanation of Composition:
	  ○ Define the composition of linear maps.
	  ○ Provide examples to illustrate the concept.
	• Steps to Compose Linear Maps:
	  ○ Discuss the method to compose linear maps.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: Composing Linear Maps
	Exercise (25 minutes)
	• Solve various problems to compose given linear maps.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Compose given linear maps and verify the results.

	○ Video Solution Examples: Composition Examples
Closure	• Summarize the key concepts covered in the lesson. • Confirm students' understanding and answer any remaining questions. • Provide additional resources for further reading: ○ Khan Academy: Linear Algebra ○ MIT OpenCourseWare: Linear Algebra https://archive.nptel.ac.in/courses/111/106/111106051/
Evaluation	• Reflective Questions (What Why Who?): ○ What is the composition of linear maps and why is it important? ○ How do you determine the result of composing two linear maps? • Allow students to discuss and reflect on these questions. • Spend 5 minutes to evaluate students' understanding through a short quiz or discussion. • Homework: Assign problems on composing different linear maps. Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 40	Course Name: Engineering Mathematics Topic: Eigenvalues and eigenvectors	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concepts of eigenvalues and eigenvectors. • Determine the eigenvalues and eigenvectors for given matrices. • Apply the concepts of eigenvalues and eigenvectors to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What are eigenvalues and eigenvectors?
	  ○ Why are they important in linear algebra?
	• Introduce Concepts:
	  ○ Briefly introduce the concepts of eigenvalues and eigenvectors.
	  ○ Explain the importance of understanding these concepts in linear algebra.
	Development (10 minutes)
	• Detailed Explanation of Eigenvalues:
	  ○ Define eigenvalues.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Eigenvalues
	• Detailed Explanation of Eigenvectors:
	  ○ Define eigenvectors.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Eigenvectors
	• Finding Eigenvalues and Eigenvectors:
	  ○ Discuss the method to find eigenvalues and eigenvectors.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: Finding Eigenvalues and Eigenvectors
	Exercise (25 minutes)
	• Solve various problems to find the eigenvalues and eigenvectors of given matrices.

	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Find the eigenvalues and eigenvectors of given matrices.
	  ○ Video Solution Examples: Eigenvalue and Eigenvector Examples
	  ○ https://nptel.ac.in/courses/111102011

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Algebra
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What are eigenvalues and eigenvectors and why are they important?
	  ○ How do you find the eigenvalues and eigenvectors of a matrix?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework: Assign problems on finding the eigenvalues and eigenvectors of different matrices.
	• Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 40	**Course Name: Engineering Mathematics** **Topic:** Symmetric, Skew-Symmetric, and Orthogonal Matrices	**Course No.: BSC-101**

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concepts of symmetric, skew-symmetric, and orthogonal matrices. • Identify symmetric, skew-symmetric, and orthogonal matrices. • Apply the concepts to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What is a symmetric matrix?
	  ○ Can you define skew-symmetric and orthogonal matrices?
	• Introduce Concepts:
	  ○ Briefly introduce the concepts of symmetric, skew-symmetric, and orthogonal matrices.
	  ○ Explain the importance of understanding these matrices in linear algebra.
	Development (10 minutes)
	• Detailed Explanation of Symmetric Matrices:
	  ○ Define symmetric matrices.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Symmetric Matrices
	• Detailed Explanation of Skew-Symmetric Matrices:
	  ○ Define skew-symmetric matrices.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Skew-Symmetric Matrices
	• Detailed Explanation of Orthogonal Matrices:
	  ○ Define orthogonal matrices.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Orthogonal Matrices

	Exercise (25 minutes)
	
	• Solve various problems to identify symmetric, skew-symmetric, and orthogonal matrices.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.
	• Additional Practice Problems:
	  ○ Identify and verify given matrices as symmetric, skew-symmetric, or orthogonal.
	  ○ Video Solution Examples: Symmetric and Skew-Symmetric Examples

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Algebra
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What are symmetric, skew-symmetric, and orthogonal matrices and why are they important?
	  ○ How do you identify these types of matrices?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework: Assign problems on identifying symmetric, skew-symmetric, and orthogonal matrices.
	• Spend 5 minutes to wrap up and consolidate

Lesson Plan No. 42	Course Name: Engineering Mathematics Topic: Eigenbases	Course No.: BSC-101

Objectives	At the end of the lesson, the student shall be able to: • Define and explain the concept of an eigenbasis. • Determine the eigenbasis for given matrices. • Apply the concept of eigenbasis to solve related problems in linear algebra.
Teaching Aids (if any)	ICT tools Whiteboard and markers

Teaching Development	**Introduction (5 minutes)**
	• Questions to Engage Students:
	  ○ What is an eigenvalue and an eigenvector?
	  ○ What do you understand by the term eigenbasis?
	• Introduce Concepts:
	  ○ Briefly introduce the concept of an eigenbasis.
	  ○ Explain the importance of understanding eigenbases in linear algebra.
	Development (10 minutes)
	• Detailed Explanation of Eigenbasis:
	  ○ Define eigenbasis.
	  ○ Provide examples to illustrate the concept.
	  ○ Video Resource: Eigenbasis
	• Finding Eigenbasis:
	  ○ Discuss the method to find the eigenbasis of a matrix.
	  ○ Provide examples and solve related problems.
	  ○ Video Resource: Finding Eigen basis
	Exercise (25 minutes)
	• Solve various problems to find the eigenbasis of given matrices.
	• Group activity: Students will work in pairs to solve given exercises and present their solutions.

	• Additional Practice Problems:
	  ○ Find the eigenbasis of given matrices.
	  ○ Video Solution Examples: Eigen basis Examples
	  ○ https://archive.nptel.ac.in/courses/111/106/111106051/

Closure	• Summarize the key concepts covered in the lesson.
	• Confirm students' understanding and answer any remaining questions.
	• Provide additional resources for further reading:
	  ○ Khan Academy: Linear Algebra
	  ○ MIT OpenCourseWare: Linear Algebra

Evaluation	• Reflective Questions (What Why Who?):
	  ○ What is an eigenbasis and why is it important?
	  ○ How do you find the eigenbasis of a matrix?
	• Allow students to discuss and reflect on these questions.
	• Spend 5 minutes to evaluate students' understanding through a short quiz or discussion.
	• Homework: Assign problems on finding the eigenbasis of different matrices.
	• Spend 5 minutes to wrap up and consolidate