Department of Civil Engineering

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Mathematics-III
2.	Course Code	BSC-302
3.	Academic Year	2024-2025
4.	Semester	3rd
5.	Number of Lesson plans	32
6.	Faculty Assigned	Dr Ria Gupta

Faculty Signature

Lesson Plan No. 1	Course Name: Mathematics-III Topic: Trapezoidal and Simpson 1/3rd rule	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of numerical integration and why it's necessary. b. Derive and apply the Trapezoidal Rule for approximating definite integrals. c. Derive and apply Simpson's 1/3rd Rule for approximating definite integrals. d. Compare the accuracy of these methods in different scenarios.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is fundamental theorem of calculus? - What is numerical integration? - Why do we need numerical methods when we have analytical methods? - Explain that these are techniques used to approximate the definite integral of a function, especially when the integral cannot be solved analytically or when only discrete data points are available. - Briefly mention where these methods are commonly used in real life applications. 2. **Development** (10 minutes): a. **Trapezoidal Rule:** **- Concept of Trapezoidal rule:** Start with the idea of approximating the area under a curve by dividing it into trapezoids instead of rectangles (which would lead to the Riemann sum). - Trapezoidal Rule is a rule that evaluates the area under the curves by dividing the total area into smaller trapezoids rather than using rectangles. This integration works by approximating the region under the graph of a function as a trapezoid, and it calculates the area. - Explain them about the formula and how it is used. - Introduce the formal concept of Trapezoidal Rule by NPTEL. - Solve a typical problem using the Trapezoidal Rule to approximate a given definite integral. b. **Simpson 1/3rd rule:** - Concept of Simpson 1/3rd rule:

	-Introduce Simpson's Rule by comparing it to the Trapezoidal Rule. Mention that it uses parabolas instead of straight lines to approximate the area under the curve, leading to more accuracy. -Simpson's Rule is a numerical method for approximating the integral of a function between two limits, a and b. It's based on knowing the area under a parabola, or a plane curve. In this rule, N is an even number and h = (b - a) / N. The y values are the function evaluated at equally spaced x values between a and b. - Explain them about the formula and how it is used. - Explain various steps for solving Simpson 1/3rd rule. **3. Exercise** (25 minutes): - Do various problems on Trapezoidal Rule and Simpson's Rule: a. Evaluate $\int_0^1 \frac{x^2}{1+x^3}\, dx$ by using Trapezoidal rule. b. Evaluate $\int_0^{\frac{\pi}{2}} \sin x\, dx$ taking eleven ordinates by using Simpsons $\frac{1}{3}$ rule.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://www.youtube.com/watch?v=DyOS2BuHL3A 3. Homework Given some questions on Trapezoidal Rule and Simpson's Rule 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. 2	Course Name: Mathematics-III Topic: Regula Falsi Method	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Analyze the concept of Regula Falsi method graphically. b. Familiar with the ways of solving complicated mathematical problems numerically. c. Able to understand the several available methods to solve the simultaneous equations. d. Tell them about its applications.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What are algebraic and transcendental equations? - How to find roots of algebraic equations? - Talk about Regula Falsi method. - Tell them about its applications. 2. **Development** (10 minutes): **a. Introduce the concept of Regula Falsi Method.** - Highlight the important characteristics of Regula Falsi Method. - Explain the steps and formula for finding the roots of the equation through regulafalsi method. **b. Applications of Regula Falsi:** - In Engineering this method is used to find the roots of characteristic equations in control system designs which are essential for analyzing system stability and designing controllers. - Solving nonlinear equations arising from circuit designs, such as finding voltages and currents in nonlinear components. **3. Exercise** (25 minutes): -Do various problems on Regula Falsi Method.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://www.youtube.com/watch?v=FliKUWUVrEI 3. Homework: - Give some questions based on Regula Falsi Method 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. 3	Course Name: Mathematics-III Topic: Newton Raphson Method	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Analyze the concept of Newton's Raphson and iterative Method. b. Able to understand Newton Raphson and iterative Method to solve the simultaneous equations. c. Talk about its applications in day to day life.
Teaching Aids (if any)	a. Chalk and Talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What are non linear equations? - How to solve simultaneous equations? - Talk about Newton Raphson and iterative Method. - Talk about its applications in day-to-day life. 2. **Development** (10 minutes): a. **Newton Raphson Method:** - Concept of Netwon Raphson Method. - Highlight the important characteristics of Newton's Raphson Method. - Graphical representation of Newton Raphson Method. - Explain the steps and formula of Newton Raphson Method. **b. Iterative Method:** - Concept of Iterative Method. - Highlight the important characteristics of Iterative Method. - Explain the steps and formula of Iterative Method. 3. **Exercise** (25 minutes) : – Do various problems on Newton's Raphson and iterative Method.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://archive.nptel.ac.in/courses/111/106/111106101/ 3. Homework: - Give some problems based on Newton's Raphson and iterative Method 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. 4	Course Name: Mathematics-III Topic: Taylor's Method and Picard's Method	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Analyze the concept of Taylor's Method and Picard's Method. b. Familiar with the ways of solving complicated mathematical problems numerically. c. Describing and understanding of the several errors and approximation in Taylor's Method. d. Talk about its applications in different branches of mathematics.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is differential equation? - What are linear and non linear differential equation? - Talk about Taylor's and Picard's Method. - Tell them about its applications in day-to-day life. - Introduce the formal concept of Taylor's Method by NPTEL. https://archive.nptel.ac.in/courses/111/106/111106101/ 2. **Development** (10 minutes): **a. Taylor's Method:** - Concept of Taylor's Method. - Explain steps and formula of Taylor's Method. - Highlight the important characteristics of Taylor's Method. - Graphical representation of Taylor's Method. **b. Picard's Method:** - Concept of Picard's Method. - Explain steps and formula of Picard's Method. - Graphical representation of Taylor's Method. 3. **Exercise** (25 minutes): - Do various problems on Taylor's Method and Picard's Method.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video http://nitttrc.edu.in/nptel/courses/video/111106101/L25.html 3. Homework: - Give some problems on Taylor's Method and Picard's Method 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. 5	Course Name: Mathematics-III Topic: Euler's and modified Euler's Method	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Analyze the concept of Euler's Method and modified Euler's Method. b. Obtaining numerical solutions to problems of mathematics. c. Describing and understanding of the several errors and approximation in Euler's Method. d. Evaluates the area under the curves. e. Talk about its applications in day to day life.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - How to find initial value in numerical analysis? - How to solve differential equations by different methods? - Talk about Euler's and modified Euler's method. - Introduce the formal concept of **Euler's Method** by NPTEL. https://archive.nptel.ac.in/courses/111/106/111106101/ 2. **Development** (10 minutes): **a. Introduce the concept Euler's and modified Euler's method.** -Steps and formula for solving various numerical problems. - Highlight the important characteristics of Euler's Method. - Steps and formula for finding Euler's and modified Euler's formula. **b. Application:** -In engineering, Euler's formula is instrumental in signal processing. - Used in Acoustic Engineering. 3. **Exercise** (25 minutes) : - Do various problems on Euler's Method and modified Euler's Method.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: http://digimat.in/nptel/courses/video/111107105/L08.html 3. Homework: - Give some problems based on Euler's and modified Euler's method 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. 6	Course Name: Mathematics-III Topic: Runge-Kutta Method	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Analyze the concept of Runge - Kutta Method. b. Obtaining numerical solutions to problems of mathematics. c. Able to understand Runge - Kutta Method of fourth order for solving first and second order equations. . d. Talk about its applications in Engineering.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What are first and second order equations? - How to solve first and second order equations by using different methods? - Tell them about Runge - Kutta Method. - Talk about its application in day to day life. 2. **Development** (10 minutes): **a. Introduce the concept of Runge - Kutta Method of fourth order.** - Explain them about the steps and formula for solving various numerical problems based on Runge – Kutta Method. -Introduce the concept of Runge - Kutta Method. https://archive.nptel.ac.in/courses/111/107/111107105/ **b. Application:** - Electrical engineers use Runge-Kutta method for analyzing the transient response of electrical circuits. - Simulating the interaction between soil and foundation systems, such as piles or spread footings, to ensure stability and safety. 3. **Exercise** (25 minutes): - Do various problems on Runge - Kutta Method.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://www.youtube.com/watch?v=DyOS2BuHL3A 3. Homework: - Give some problems on Runge - Kutta Method 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: Mathematics-III Topic: Laplace transform and its properties	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Laplace Transform and its properties. b. To make strong foundation of the integral transforms and their inverses. c. Able to understand Laplace transforms. d. The students will be able to solve ordinary differential equations using Laplace transform. e. Able to understand the use of Laplace Transform to solve real world problems.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - Which valuable "tool" is used in solving: a. Differential equations for example: electronic circuit equations b. In "feedback control" for example, in stability and control of aircraft systems. - Talk about its applications in day to day life. - Introduce the formal concept of Laplace Transform by NPTEL https://nptel.ac.in/content/storage2/111/106/111106139/MP4/mod01lec01.mp4 2. **Development** (15 minutes) **a. Laplace Transform.** **-** Explain the concept of Laplace transform and kits properties. - Highlight the important characteristics of Laplace Transform. **b. Properties:** - Concept of Properties of Laplace Transform. https://nptel.ac.in/content/storage2/111/106/111106139/MP4/mod01lec06.mp4 - Linearity Property - Time Scaling - Frequency Scaling - Scaling in time 3. **Exercise** (20 minutes) : -Do various problems on Laplace transform and its properties.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video:

	https://nptel.ac.in/content/storage2/111/106/111106139/MP4/mod01lec06.mp4 3. Homework: - Give some questions on Laplace Transform and its properties 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: Mathematics-III Topic: Unit step function and impulse function	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of unit step function and impulse function. b. Understand the concept of first and second shifting property and t-property? c. To make strong foundation of the Laplace transform. d. Able to understand the use of unit step and impulse function to solve real world problems.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is Laplace transform? - What are the properties of Laplace transform?\ - What is shifting property? - Talk about its applications in day to day life. - Introduce the formal concept of unit step and impulse function by NPTEL 2. **Development** (15 minutes) **a. Unit step function:** - Explain the concept of unit step function and its properties. - Concept of t-property. - Explain the properties and steps to solve problems based on unit step function. **b. Impulse function:** Explain the concept of impulse function and its properties. - Concept of first and second shifting property. - Explain the properties and steps to solve problems based on impulse function. 3. **Exercise** (20 minutes) : -Do various problems on unit step and impulse function. - Solve problems on first and second shifting property, t-property.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: http://digimat.in/nptel/courses/video/111107098/L34.html 3. Homework: - Give some questions on unit step and impulse function 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: Mathematics-III Topic: Application to solve initial and boundary value problem	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of initial and boundary value problem. b. To strengthen the analytical abilities of the students. c. Able to understand the application to solve initial value and boundary value problem.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is initial value and boundary value? -What is t-property? - What are the applications of Laplace transform? - Talk about its applications in day to day life. - Introduce the formal concept of initial and boundary value by NPTEL 2. **Development** (10 minutes) **a. Initial value problem:** - Concept of initial value problem. - Various steps to solve initial value problem. - Examples and applications of Initial value problem. **b. Boundary value problem:** - Concept of boundary value problem - Steps and examples of boundary value problem. - Applications of initial and boundary value problem. 3. Exercise (25 minutes) : -Do various problems on initial and boundary value problem.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://archive.nptel.ac.in/courses/111/106/111106139/ 3. Homework: - Give some problems based on initial and boundary value 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: Mathematics-III Topic: Laplace transform of periodic function	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of periodic function. b. To strengthen the analytical abilities of the students. c. Able to understand the applications of periodic function.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is periodic function? - State initial and final value theorem? - Talk about Laplace transform of periodic function. - Talk about its applications in day to day life. 2. **Development** (10 minutes) **a. Periodic function:** **-** Explain the concept of periodic function. **-** Explain steps for solving Laplace transform of periodic function. **b. Application:** - Simplifies the analysis and solution of differential equations involving periodic inputs. - Analysis and solution of differential equations involving periodic inputs. 3. **Exercise** (25 minutes) : -Do various problems on Laplace transform of periodic function.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: - http://acl.digimat.in/nptel/courses/video/111106139/L14.html 3. Homework: - Give some problems based on Laplace transform of periodic function 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. 11	Course Name: Mathematics-III Topic: Laplace transform of derivatives	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Laplace Transform of derivatives. b. Able to solve derivatives using Laplace transform. c. Talk about its applications in day to day life.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is Laplace transform? - How we can Laplace transform by using different methods? - Talk about its applications in day to day life. 2. **Development** (15 minutes) **a. Laplace transform of derivatives:** **- Concept of Laplace transform of derivatives.** - Characteristics of Laplace Transform of derivatives. - Explain the steps to solve derivatives using Laplace transform. **b. Application:** **-** Allows the conversion of differential equations into algebraic equations, which simplifies the solution process. 3. **Exercise** (20 minutes) : -Do various problems to solve the Derivatives by using Laplace transform?
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://nptel.ac.in/content/storage2/111/106/111106139/MP4/mod02lec12.mp4 3. Homework: - Give some problems on Laplace Transform of derivatives and its properties 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 12	Course Name: Mathematics-III Topic: Inverse Laplace transform, its properties and its different methods	Course No.: BSC-301

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of inverse Laplace transform. b. Able to understand existence and properties of inverse Laplace transform. c. Students will be able to solve inverse Laplace transform by different methods.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - State Linear property? - State first and second shifting property? - Tell them about inverse Laplace and its properties. - Talk about its applications in day to day life. - Introduce the formal concept of Laplace Transform by NPTEL 2. **Development** (10 minutes) **a. Inverse Laplace Transform.** -Explain the concept of inverse Laplace transform and its properties. -Important characteristics of Laplace Transform. - Properties of inverse Laplace Transform. **b. Methods of inverse Laplace transform:** - Partial Fraction Decomposition - Heaviside Expansion Formula 3. **Exercise** (25 minutes) : -Do various problems on inverse Laplace transform by different methods.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://digimat.in/nptel/courses/video/111106139/L17.html 3. Homework: - Give some questions based on inverse Laplace transform by different method 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: Mathematics-III Topic: Convolution theorem	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Convolution Property of Laplace Transform. b. The students will be able to understand the use of convolution property in solving the problems of Laplace transform.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - State multiplication by t-property? -State division by t-property? -What is convolution product? - Talk about its applications in day to day life. - Introduce the formal concept of Convolution Property by NPTEL https://www.youtube.com/watch?v=DPg5T-YBQjU 2. **Development** (15 minutes) a. **Convolution Property of Laplace Transform**. - Statement of Convolution property. - Highlight the important characteristics of Convolution Property of Laplace Transform. https://www.youtube.com/watch?v=WAC-snuvpak - Introduce the concept of Properties of Inverse Laplace Transform. https://nptel.ac.in/content/storage2/111/105/111105123/MP4/mod02lec06.mp4 **b. Application:** -Useful in solving linear time-invariant (LTI) systems described by differential equations. - Solve for the output in terms of the input using algebraic methods. 3. **Exercise** (20 minutes) : -Do various problems on convolution Property.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: http://www.nitttrc.edu.in/nptel/courses/video/111106139/L21.html 3. Homework: - Give some questions on Convolution Property of Laplace Transform 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 14	Course Name: Mathematics-III Topic: Evaluation of integrals by Laplace transform	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of integral transformation. b. Understand to evaluate integrals using Laplace technique. c. Talk about applications of Laplace transforms to evaluate integrals.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is integral? -Difference between proper and improper integral? - How to evaluate integral using general method? - Talk about evaluation of integrals using Laplace transforms. -Talk about applications of Laplace transforms to evaluate integrals. **2. Development** (15 minutes) a. **Integrals using Laplace Transform**: - Concept of Laplace transform using integral - Highlight the important characteristics of integrals. -Explain steps to solve integrals using Laplace transform. b. **Application:** **-** Solve complex integral and differential equations. 3. **Exercise** (20 minutes) : -Do various problems on Evaluation of integrals using Laplace transforms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: http://www.nitttrc.edu.in/nptel/courses/video/111106139/L21.html 3. Homework: - Give some questions on Evaluation of integrals using Laplace Transform 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. - Quiz based activity including MCQs.

	Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 15	Course Name: Mathematics-III Topic: Application of Laplace transforms to solve differential equations	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept to solve differential equations using Laplace transforms. b. Able to understand the applications of Laplace transform to solve differential equations.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is differential equation? - How ordinary and higher order differential equations differ from each other? - Talk about general form of differential equation. - Talk about its applications in day to day life. 2. **Development** (10 minutes) **a. Solve differential equation using Laplace transform:** **-** Concept to solve differential equation using Laplace. **-** Explain the steps to solve differential equation using Laplace transform. **b.** Second-Order Differential Equation: - Steps to solve second differential equation using Laplace Transform. - Application of differential equation in Laplace transforms. 3. **Exercise** (25 minutes) : -Do various problems on differential equations using Laplace transforms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://www.youtube.com/watch?v=3uYb-RhM7lU 3. Homework: - Give some problems based on differential equations 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 16	Course Name: Mathematics-III Topic: Application of Laplace transforms to solve partial differential equations	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept to solve partial differential equations using Laplace transforms. b. Able to understand the applications of Laplace transform to solve partial differential equations.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is partial differential equation? - Differentiate differential equation and partial differential equation? - Talk about its applications in day to day life. 2. **Development** (10 minutes) **a. Partial differential equation using Laplace transforms.** - Concept to solve partial differential equation using Lplace. - Explain the steps to solve partial differential equation using Laplace transform. **b. Application:** - Heat Equation - Wave Equation 3. **Exercise** (25 minutes) : -Do various problems on partial differential equations using Laplace transforms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested video: https://www.youtube.com/watch?v=RggTx6cuXag 3. Homework: - Give some problems based on partial differential equations 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. 17	Course Name: Mathematics-III Topic: Introduction and Euler's formula	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of Fourier series. b. Derive and comprehend Euler's formulas for Fourier coefficients. c. Apply Euler's formulas to simple periodic functions.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is periodic function? - What do you know about sine and cosine form of 2π- Periodic function? - What do you understand by Fourier Series? - Talk about common forms of Fourier series **-** Talk about its applications in day-to-day life. **2. Development** (10 minutes) **a. Fourier series:** **-** Definition of Fourier series - Explain types of Fourier series, their properties. - Formula for solving Fourier series. - Highlight the important characteristics of Fourier Series. **b. Euler's formula:** - Derive Euler's formulas for Fourier coefficients. - Illustrate the derivation with a simple example. **3. Exercise** (25 minutes): -Do various problems on Fourier Series and Euler's formula.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://archive.nptel.ac.in/courses/111/105/111105123/ 3. Homework: - Give some questions based on Fourier series and Euler's formula 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 18	Course Name: Mathematics-III Topic: Sufficient conditions for a Fourier expansion, functions having points of discontinuity	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the sufficient conditions under which a function can be expanded into a Fourier series. b. Analyze how Fourier series behaves for functions with points of discontinuity.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What happens if a function has a point of discontinuity? - Can it still be represented by a Fourier series? - Discuss the concept of function continuity and periodicity. - Talk about its applications in day-to-day life. **2. Development** (10 minutes) **a**. Dirichlet conditions**:** **-** Explain the Dirichlet conditions for a function to have a Fourier series. **b. Functions having points of discontinuity:** - Discuss how fourier series approximates discontinuous functions. - Provide examples illustrating Fourier series for functions with discontinuities. **3. Exercise** (25 minutes): - Solve problems on determining whether a function satisfies the sufficient conditions for Fourier expansion. - Analyze the Fourier series of functions with jump discontinuities.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: 3. Homework: - Give some questions based on function satisfies the sufficient conditions for Fourier expansion. Spend 5 minutes to wrap up and consolidate the learning's.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Quiz based activity including MCQs.

	Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 19	Course Name: Mathematics-III Topic: Change of Interval	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Learn how to change the interval of a Fourier series. b. Understand the implications of changing the interval on the Fourier coefficients.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - Why one might need to change the interval? - What if the function is defined on a different interval - Discuss the standard interval for Fourier series - Talk about its applications in day-to-day life. 2. **Development** (10 minutes) a. **Changing of Interval:** - Explain the method of changing the interval in a Fourier series. - Provide a step-by-step example of transforming the interval from π to + π to a different interval. - Discuss the impact on Fourier coefficients. 3. **Exercise** (25 minutes): - Practice problems involving changing the interval and calculating the corresponding Fourier series.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: 3. Homework: - Give some questions involving interval transformations in Fourier 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 20	Course Name: Mathematics-III Topic: Odd and Even Functions and Fourier Expansion of Odd and Even Periodic Functions	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Differentiate between odd and even functions. b. Develop Fourier expansions for odd and even periodic functions.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What makes a function odd or even? - What if the function is defined on a different interval - How does symmetry affect its Fourier series? - Talk about its applications in day-to-day life. **2. Development** (10 minutes) **a. Odd and Even Functions:** - Define odd and even functions. - Explain how the symmetry of a function affects its Fourier series (e.g., odd functions result in sine series, even functions result in cosine series). - Provide examples of Fourier series expansions for odd and even functions. **3. Exercise** (25 minutes): - Work on exercises that involve identifying whether a function is odd or even and finding its Fourier series.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: 3. Homework: - Give some problems on finding Fourier series for odd and even functions 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 21	Course Name: Mathematics-III Topic: Half range series	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of half-range expansions in Fourier series. b. Develop the ability to compute half-range sine and cosine series.
Teaching Aids (if any)	a. Chalk and talk b. Group discussion
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What if we are only interested in a function over half of its period? - Discuss the concept of extending a function to a full period and the necessity of half-range expansions. - Talk about its applications in day-to-day life. **2. Development** (10 minutes) **a. Half range Series:** - Explain the derivation of half-range sine and cosine series. - Provide examples where half-range expansions are used. **3. Exercise** (25 minutes): - Solve problems that involve deriving half-range Fourier series for given functions.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: 3. Homework: - Give some problems on finding Fourier series for odd and even functions 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. - Quiz based activity including MCQs. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 22	Course Name: Mathematics-III Topic: Typical waveform	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Identify and analyze typical waveforms using Fourier series. b. Develop the ability to approximate waveforms like square, triangular, and sawtooth using Fourier series.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions -How can we approximate a square or triangular wave using sine and cosine functions? -Introduce the concept of representing waveforms with Fourier series. - Talk about its applications in day-to-day life. **2. Development** (10 minutes) **a. Typical wave form:** - Discuss the Fourier series representation of typical waveforms (e.g., square, triangular). - Show examples of how these waveforms are constructed using Fourier series. **b. Applications:** **3. Exercise** (25 minutes): - Solve problems involving the Fourier series of typical waveforms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: 3. Homework: - Give some problems on waveform related Fourier 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. 23	Course Name: Mathematics-III Topic: Parseval's Formula	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept and derivation of Parseval's Formula. b. Apply Parseval's Formula to solve problems involving Fourier series. c. Recognize the significance of Parseval's Formula in energy conservation within signals.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is Fourier Series? -How Fourier series allows functions to be represented as a sum of sines and cosines? -Introduce Parseval's Formula as an extension of the Pythagorean theorem applied to functions, where it relates the total energy of a function to the sum of the squares of its Fourier coefficients. **-** Talk about its applications in day-to-day life. 2. **Development** (10 minutes) **a. Derivation of Parseval's Formula:** - Begin with the Fourier series representation of a function f(x) defined over a period $[-\pi, \pi]$. - Explain how the square of the function can be represented as the square of the Fourier series, involving cross terms. -Derive the expression that leads to Parseval's Formula. - Break down the steps and ensure students follow the logic of the derivation. **b. Physical Interpretation:** **-** Discuss how Parseval's Formula represents the conservation of energy, where the total energy of the function f(x) is equal to the sum of the energies of its individual Fourier components. **-** Illustrate this with examples from signal processing where the energy content of a signal is distributed among its frequency components. **c. Example Problem:** **-** Solve a typical problem where students are required to apply Parseval's Formula to calculate the total energy of a function given its Fourier series. 3. **Exercise** (25 minutes): - Solve problems involving the Parseval's Formula: a. Using Parseval's Identity , show that $\int_0^{\infty} \frac{dx}{(x^2+1)^2} = \frac{\pi}{4}$

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=6gFgSDk1jUw 3. Homework: - Give some problems on Parseval's Formula 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. 24	Course Name: Mathematics-III Topic: Power Series	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand how Fourier series can be expressed as power series. b. Analyze the convergence of Fourier series when represented as power series. c. Apply the concept of power series in solving Fourier series problems.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions -What is a series? - How do we represent periodic functions using trigonometric series? - Introduce the concept of representing Fourier series as power series. -Discuss the relevance of power series in the analysis of Fourier series, particularly in terms of convergence and function representation. 2. **Development** (10 minutes) a. **Overview of Fourier Series and Power Series:** - Briefly review the Fourier series expansion of a function f(x) as a sum of sines and cosines. - Introduce the idea that Fourier series can also be viewed as a type of power series, particularly when the terms involve powers of variables. **b. Convergence of Fourier Series as Power Series:** - Discuss the convergence criteria for Fourier series and compare them with the convergence of power series. -Explain the importance of the radius of convergence when Fourier series are treated as power series. **c. Applications and Examples:** - Show examples where Fourier series are expressed as power series, especially in solving differential equations. - Illustrate how power series representations of Fourier series can simplify calculations in signal processing and other applied fields. 3. **Exercise** (25 minutes): - Solve problems involving the representation and convergence of Fourier series as power series: a. Express given Fourier series as power series and analyze their convergence.

	b. Apply power series methods to solve differential equations where Fourier series are involved.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=LGxE_yZYigI 3. Homework: - Give some problems involve the analysis of Fourier series as power 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. 25	Course Name: Mathematics-III Topic: Solutions of second order ODE.	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the method of solving second-order ordinary differential equations using Fourier series. b. Derive the Fourier series representation of the solution to a second-order ODE. c. Apply Fourier series to solve specific second-order ODE problems. d. Interpret the physical significance of Fourier series solutions in various engineering contexts.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is an ordinary differential equation (ODE)? - What is Fourier series? - How can Fourier series be used to solve differential equations? - Briefly introduce the topic by explaining that second-order ODEs are common in various fields, such as mechanics and electrical circuits, and Fourier series is a powerful tool for finding their solutions. 2. **Development** (10 minutes): **a. Introduction to Fourier Series Solution Method:** - Discuss how Fourier series can represent periodic solutions of ODEs. - Explain the general form of a second-order ODE. - Highlight the conditions under which Fourier series can be applied (e.g., periodic boundary conditions). b. **Derivation Process:** - Begin with a simple example, such as $y''(x)+\omega^2(x)=f(x)$ - Assume the solution y(x) can be expanded in a Fourier series. -Substitute the Fourier series into the ODE and equate coefficients for each harmonic term to derive the formulas for a_n and b_n. c. **Application of the Fourier Series to Solve ODEs:** - Work through a specific example: solve $y''(x)+\omega^2y(x)=\sin(x)$ over $[0,2\pi]$ using Fourier series. - Show how the Fourier coefficients are determined and how the final solution is constructed. **Physical Interpretation and Examples:** Discuss the physical significance of the Fourier series solution in real-world problems.

	3. Exercise (25 minutes): - Solve various problems on solutions of second order ODE. a. Solve $y''(x) + 4y(x) = x^2$ over $[0,2\pi]$. - Solve a non-homogeneous ODE with given boundary conditions.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.digimat.in/nptel/courses/video/111107119/L39.html 3. Homework: - Give problems to solve second-order ODEs using Fourier series. 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. 26	Course Name: Mathematics-III Topic: Fourier Integral	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of Fourier integrals and their significance. b. Derive the Fourier integral representation of a given function. c. Apply Fourier integrals to solve problems involving non-periodic functions. d. Recognize the applications of Fourier integrals in various fields such as signal processing and physics.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is a Fourier series and how is it used to represent periodic functions? - What if the function is non-periodic? - Can we still use a similar approach? -Introduce the concept of Fourier integrals as an extension of Fourier series to non-periodic functions. - Briefly explain the importance of Fourier integrals in various applications. 2. **Development** (10 minutes): **a. Introduction to Fourier Integrals:** - Explain that while Fourier series represent periodic functions, Fourier integrals are used to represent non-periodic functions. - Discuss the idea that a non-periodic function can be viewed as a limit of a periodic function with an infinite period. - Introduce the Fourier integral formulas. -Define the Fourier transform F(ω) and its inverse, emphasizing their roles in converting a function from time/space domain to frequency domain and vice versa. b. **Derivation Process:** - Explain the steps involved in deriving the Fourier transform and the inverse Fourier transform. - Work through the derivation carefully, ensuring that students understand each step. c. **Application of Fourier Integrals:** - Solve a specific example, such as finding the Fourier integral representation of a simple function like $f(x)=e^{-\|x\|}$ - Discuss the implications of the results and how Fourier integrals can be used to solve practical problems. **3. Exercise (25 minutes):**

	- Provide several problems of Fourier integrals, such as compute the Fourier transform of a given function and use it to solve an integral equation.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=7oZyB-fVTSA 3. Homework: - Give problems of Fourier integrals 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. 27	Course Name: Mathematics-III Topic: Fourier Integral theorem and their inverses	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the Fourier Integral Theorem. b. Derive and apply the inverse Fourier integrals. c. Analyze applications of the Fourier Integral Theorem in solving problems.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	1. **Introduction** (5 minutes) - Ask questions - What is Fourier series and how is it related to periodic functions? - Have you heard about Fourier transforms? How do they differ from Fourier series? - Discuss the need for Fourier integrals when dealing with non-periodic functions. 2. **Development** (10 minutes): **a. Fourier Integral Theorem :** - Introduce the Fourier Integral Theorem and provide the mathematical formulation - Explain the conditions under which this theorem holds, emphasizing the Dirichlet conditions. b**. Inverse Fourier Transform :** - Derive the inverse Fourier transform formula, which allows the reconstruction of the original function from its Fourier transform. - - Explain how the Fourier Integral Theorem and its inverse are used together to analyze non-periodic functions. **c. Applications:** **-**Provide examples where the Fourier Integral Theorem is applied in solving differential equations. 3. **Exercise (25 minutes):** **-** Provide several problems of Fourier Integral Theorem and its inverse.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: http://nptelvideos.com/video.php?id=119 3. Homework: - Give problems of the derivation and application of Fourier integrals

	and their inverses 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. 28	Course Name: Mathematics-III Topic: Properties of Fourier Transforms	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand and explain the basic properties of the Fourier Transform. b. Apply these properties to simplify the analysis of signals and systems. c. Solve problems using the linearity, time-shifting, frequency-shifting, scaling, and convolution properties of the Fourier Transform.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	**1. Introduction** (5 minutes) - Ask questions - What do you know about the Fourier Transform? - Can anyone mention a property of the Fourier Transform? - Highlight the importance of knowing the properties of the Fourier Transform in simplifying calculations and understanding signal behavior. **2. Development** (10 minutes): **a. Linearity Property:** Introduce and explain the linearity property. Discuss how the Fourier Transform of a sum of functions is the sum of their Fourier Transforms. **b. Time Shifting Property:** Explain the time-shifting property. Show how shifting a function in time affects its Fourier Transform. **c. Frequency Shifting Property:** Discuss the frequency-shifting property. Demonstrate how multiplying a function by an exponential term results in a frequency shift in the Fourier domain. **d. Scaling Property:** Introduce the scaling property. Explain how stretching or compressing a function in time affects its Fourier Transform. **e. Convolution Property:** Explain the convolution theorem, showing that the Fourier Transform of a convolution of two functions is the product of their Fourier Transforms. **3. Exercise (25 minutes):** - Provide several problems that require the application of these properties to solve. - Encourage students to work through the problems in pairs or

	small groups.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=11b5NnpEoVE 3. Homework: - Give problems on properties of Fourier transform 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. 29	Course Name: Mathematics-III Topic: Application of Fourier transform to solve integral equations	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of Fourier Transforms and its application to integral equations. b. Apply Fourier Transforms to convert integral equations into algebraic equations. c. Solve integral equations using Fourier Transform techniques.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	**1. Introduction** (5 minutes) - Ask questions - What do you understand by Fourier Transform? - How does Fourier Transform help in simplifying problems? - Have you encountered any integral equations before? -Discuss how Fourier Transforms simplify the process of solving integral equations by converting them into algebraic equations. - Emphasize the application of Fourier Transforms in various fields like signal processing, physics, and engineering. **2. Development** (15 minutes): **a. Recap of Fourier Transform:** - Briefly review the definition and properties of Fourier Transform. - Explain how Fourier Transform can be used to analyze signals and solve differential equations. **b. Application to Integral Equations:** **i. Introduction to Integral Equations:** Define what an integral equation is and present examples. **ii. Converting Integral Equations using Fourier Transform:** Demonstrate the process of applying Fourier Transform to an integral equation. Show how this transformation simplifies the equation into an algebraic form. **iii. Inverse Fourier Transform:** Discuss the importance of using the Inverse Fourier Transform to retrieve the solution in the original domain. **3. Exercise (20 minutes):** - Distribute a set of problems that involve solving integral equations using Fourier Transform. - Guide them through the solutions, emphasizing the process of transforming and inverting the equations.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=11b5NnpEoVE 3. Homework: - Give problems on the application of Fourier Transforms to solve different types of integral equations. 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. 30	Course Name: Mathematics-III Topic: Fourier sine integral and their inverses	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of Fourier sine integrals. b. Derive and apply the Fourier sine integral for a given function. c. Derive and apply the inverse Fourier sine integral to retrieve the original function from its Fourier sine transform. d. Understand the conditions under which the Fourier sine integrals are applicable.
Teaching Aids (if any)	**a.** Chalk and talk
Teaching Development	**1. Introduction** (5 minutes) - Ask questions - What is a Fourier series? - How can a function be represented using integrals? - Introduce the concept of Fourier integrals, focusing on the sine integral. - Mention applications of Fourier sine integrals in solving boundary value problems, such as heat conduction problems. **2. Development** (15 minutes): **a. Fourier Sine Integral:** **Concept:** Introduce the Fourier sine integral as a way to represent a function f(x) defined on [0, ∞). $$f(x)=\int_0^\infty F(s)\sin sx\,ds$$ where F(s) is the Fourier sine transform of f(x). - Discuss the assumptions on f(x), such as being absolutely integrable over [0,∞) **Derivation:** **-** Derive the Fourier sine transform F(s) of a function f(x) $$F(s)=\int_0^\infty f(x)\sin sx\,dx$$ - Explain the conditions for the existence of the Fourier sine transform. **b. Inverse Fourier Sine Integral:** **Concept:** Discuss the inverse Fourier sine transform, which allows one to recover f(x) from its sine transform F(s). **-** Provide the formula for the inverse sine transform: $$f(x)=\frac{2}{\pi}\int_0^\infty F(s)\sin sx\,ds$$

	Derivation: - Derive the inverse Fourier sine integral from the original Fourier sine integral formula. - Discuss the properties of Fourier sine integrals that make them useful in solving differential equations, particularly in physics. **3. Exercise (20 minutes):** Work through several problems where students are required to: a. Compute the Fourier sine integral of a given function. b. Apply the inverse Fourier sine integral to find the original function from a given sine transform.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=7oZyB-fVTSA 3. Homework: - Give problems on Fourier sine integral of a given function. Spend 5 minutes to wrap up and consolidate the learning's.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Quiz based activity on MCQs Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 31	Course Name: Mathematics-III Topic: Fourier cosine integral and their inverses	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of Fourier cosine integrals. b. Derive and apply the Fourier sine integral for a given function. c. Derive and apply the inverse Fourier cosine integral to retrieve the original function from its Fourier sine transform. d. Understand the conditions under which the Fourier cosine integrals are applicable.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	**1. Introduction** (5 minutes) - Ask questions - What is a Fourier series? - How can a function be represented using integrals? - Introduce the concept of Fourier integrals focusing on the cosine integral. - Mention applications of Fourier cosine integrals in solving boundary value problems. **2. Development** (15 minutes): **a. Fourier Cosine Integral:** **Concept:** Introduce the Fourier cosine integral as a way to represent a function f(x) defined on [0, ∞). $$f(x)=\int_0^\infty F_c(s)\cos(sx)\,ds$$ where $F_c(s)$ is the Fourier sine transform of f(x). - Discuss the assumptions on f(x), such as being absolutely integrable over [0,∞) **Derivation:** **-** Derive the Fourier cosine transform $F_c(s)$ of a function f(x) defined as: $$F_c(s)=\int_0^\infty f(x)\cos(sx)\,dx$$ - Explain the conditions for the existence of the Fourier cosine transform. **b. Inverse Fourier Cosine Integral:** **Concept:** Discuss the inverse Fourier cosine transform, which allows one to recover f(x) from its cosine transform $F_c(s)$. **-** Provide the formula for the inverse cosine transform:

	$$f(x)=\frac{2}{\pi}\int_0^{\infty} F_c(x)\cos(sx)ds$$ **Derivation:** - Derive the inverse Fourier cosine integral from the original Fourier cosine integral formula. - Discuss the properties of Fourier cosine integrals that make them useful in solving differential equations, particularly in physics. **3. Exercise (20 minutes):** Work through several problems where students are required to: a. Compute the Fourier cosine integral of a given function. b. Apply the inverse Fourier cosine integral to find the original function from a given cosine transform.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://www.youtube.com/watch?v=7oZyB-fVTSA 3. Homework: - Give problems on Fourier cosine integral of a given function. Spend 5 minutes to wrap up and consolidate the learning's.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Quiz based activity on MCQs Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 32	Course Name: Mathematics-III Topic: Solutions of Partial Differential Equations (PDEs) by Fourier Transform	Course No.: BSC-302

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept and application of the Fourier transform in solving PDEs. b. Apply the Fourier transform to solve standard PDEs. c. Comprehend the inverse Fourier transform and its role in retrieving the original function. d. Recognize the conditions under which the Fourier transform is applicable in solving PDEs.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	**1. Introduction** (5 minutes) - Ask questions - What do you know about Fourier series? - How do we use Fourier series to solve boundary value problems? -Briefly discuss the applications of Fourier transforms in various fields such as signal processing, quantum mechanics, and engineering. **2. Development** (20 minutes): a. **Fourier Transform:** **Concept:** -Introduce the Fourier transform as a generalization of the Fourier series, particularly useful for non-periodic functions. - Present the Fourier transform of a function f(x) defined as: $$\hat{f}(k)=\int_{-\infty}^{\infty} f(x)e^{-ikx}dx$$ **Derivation:** - Derive the Fourier transform for simple functions such as f(x) = e^{-ax^2} where a> 0. - Discuss conditions under which the Fourier transform exists, such as the function being absolutely integrable. **b. Inverse Fourier Transform:** **Concept:** - Explain the inverse Fourier transform, which retrieves the original function from its transform: $$f(x)=\frac{1}{2\pi}\int_{-\infty}^{\infty} \hat{f}(k)e^{ikx}dk$$ **Application:** Show how the inverse transform is used to solve initial and

	boundary value problems in PDEs. **c. Solving PDEs Using Fourier Transform:** **Heat Equation:** - Apply the Fourier transform to the one-dimensional heat equation. - Solve the resulting ordinary differential equation (ODE) in the frequency domain and then apply the inverse Fourier transform to obtain the solution in the time domain. **Wave Equation:** Solve the one-dimensional wave equation using Fourier transforms. **3. Exercise (15 minutes):** Work through several problems where students: a. Compute the Fourier transform of given functions. b. Solve specific PDEs using Fourier transform techniques. c. Apply the inverse Fourier transform to retrieve the solutions in the original domain.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Video: https://archive.nptel.ac.in/courses/111/102/111102129/ 3. Homework: - Assign problems that require students to compute Fourier transforms and solve basic PDEs using the Fourier transform method. Spend 5 minutes to wrap up and consolidate the learning's.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Quiz based activity on MCQs Spend 5 minutes to evaluate student assimilation of the lesson contents.