



# LESSON PLAN

## (MTH324 : MATHEMATICAL METHODS)

### COURSE TEACHER

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### OFFICE

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### COURSE DESCRIPTION

Mathematical methods is a compulsory course for students enrolled in the B. Sc. (Hons.) program, which carries 3.0 credits with 42 hours of effective class teaching time. This course focuses on powerful mathematical techniques such as **Fourier series**, **Fouries transforms**, **Laplace transforms**, and their **application** in solving ordinary and partial differential equations representing real-world problems arising in Mathematics, physics, and Engineering areas.

### COURSE LEARNING OUTCOMES

After the successful compilation of this course, the students will be able:

- ❖ To know the concept of Fourier series and its different properties.
- ❖ To apply the Fouries series to solve both the ordinary and partial differential equations.
- ❖ To know the concept of Fourier transforms and its different properties.
- ❖ To apply the Fouries transforms to solve the partial differential equations such as heat, wave, and Laplace equations.
- ❖ To know the concept of Laplace transforms and its different properties.
- ❖ To apply the Laplace transforms to solve both the ordinary and partial differential equations arising in the many scientific areas.

### COURSE CONTENTS

#### **Fourier Series:**

Fourier series and its convergence, Fourier sine and cosine series, Properties of Fourier series, Operation on Fourier series, Complex form, Application of Fourier series.

#### **Fourier Transforms:**

Fourier transforms, Sine and cosine transforms, Transform of derivatives, Transforms of rational function, Convolution theorem, Parseval's theorem, Applications to boundary value problems and integral equations.

#### **Laplace Transforms:**

Laplace transforms, Review of basic definition and properties, Existence theorem, Transforms of derivatives, Relations involving integrals, Transforms of periodic functions, Transforms of convolutions, Inverse Laplace transform, Calculation of inverse transforms, Use of contour integrations, Application to initial value problems, Application to ordinary differential equations, Application to boundary value problems related to PDEs.

#### **Eigenvalue problems and Strum-Liouville boundary value problems:**

Regular Strum-Liouville boundary value problems, Nonhomogeneous boundary value problems and the Fredholm alternative, Solution by Eigen function expansion, Green's functions, Singular Strum-Liouville boundary value problems/Oscillation and comparison theory.

## LECTURE SCHEDULE

Lectures	Topics to be covered	Expected Learning Outcomes	Assessment
01	<ul style="list-style-type: none"> <li>✓ Introductory Class</li> <li>✓ Some pre-requisite topics will be discussed</li> </ul>	Preparation for the course	Asking question
02-05	<ul style="list-style-type: none"> <li>✓ Introduction to Fourier series</li> <li>✓ Properties of Fouries series</li> <li>✓ Fourier sine and cosine series</li> <li>✓ Complex form of Fourier series</li> </ul>	Improving basic knowledge about Fourier series	Asking question, Assignment task-1
06-09	<ul style="list-style-type: none"> <li>✓ Finding Fourier series for some functions</li> <li>✓ Application to boundary value problems</li> </ul>	Gathering knowledge about how to find solution of boundary value problems using Fourier series	Assignment task-2
<b>Mid term -1</b>		Overall understanding and perception will be evaluated from Lecture 02-09	
10	<ul style="list-style-type: none"> <li>✓ Introduction to Fourier transforms</li> <li>✓ Sine and cosine transforms</li> </ul>	Improving basic knowledge about Fourier transforms	Asking question
11-13	<ul style="list-style-type: none"> <li>✓ Convolution theorem</li> <li>✓ Parseval's theorem</li> </ul>	To know about some theories	
14-16	<ul style="list-style-type: none"> <li>✓ Application to boundary value problems</li> </ul>	To know how to solve a boundary value problem using Fourier transform	Assignment task-3
17	<ul style="list-style-type: none"> <li>✓ Introduction to Laplace transforms</li> <li>✓ Properties of Laplace transforms</li> </ul>	Improving basic knowledge about Laplace transforms	Asking question
18-21	<ul style="list-style-type: none"> <li>✓ Laplace transforms of derivatives, convolution properties</li> <li>✓ Laplace transforms of periodic functions</li> </ul>	Improving knowledge about Laplace transforms of various functions	Assignment task-4
22	<ul style="list-style-type: none"> <li>✓ Introduction to inverse Laplace transforms</li> <li>✓ Properties of inverse Laplace transforms</li> </ul>	Knowing the concept of inverse Laplace transforms	Asking question
23-27	<ul style="list-style-type: none"> <li>✓ Application to initial and boundary value problems</li> </ul>	To know how to solve differential equations using Laplace transforms	Assignment task-5
<b>Mid term -2</b>		Overall understanding and perception will be evaluated from Lecture 17-27	
28-31	<ul style="list-style-type: none"> <li>✓ Introduction Eigenvalue problems</li> <li>✓ Solution by eigen function expansion</li> <li>✓ Solution by Green's function</li> </ul>	Learning the solution process for some problems	Assignment task-6
32-35	<ul style="list-style-type: none"> <li>✓ Introduction and solving Strum-Liouville boundary value problems</li> <li>✓ Singular Strum-Liouville boundary value problems</li> <li>✓ Nonhomogeneous boundary value problems</li> </ul>	Learning the solution process for some problems	Assignment task-7
<b>Presentation and Assignment submission</b>		<ul style="list-style-type: none"> <li>✓ Assignment submission and presentation date will be announced by teacher.</li> <li>✓ Every student will have to present any one topic from the syllabus of this course.</li> </ul>	
<b>Semester Final Exam according to the date declared by the exam committee</b>			

## BOOKS

### Reference book(s)

#### 1. Laplace Transform

Murray R. Spiegel  
Schaum's Outline Series

#### 2. Fourier Transform

Murray R. Spiegel  
Schaum's Outline Series

#### 3. Engineering Mathematics

S.S. Sastry

### Reference Material(s)

❖ Class Lectures

## ASSESSMENT POLICY

	Probable Date	Syllabus
Mid term-1 (10 Marks)	It will be declared on class.	Teacher will declare the contents for mid terms.
Mid term-2 (10 Marks)	It will be declared on class.	
Assignment (05 Marks)	After completion the course	Will be given in class
Presentation (10 Marks)	After completion the course	Topic will be announced in the class
Final Exam (60 Marks)	According to the date declared by the exam committee	All lectures
Class Attendance (05 Marks)	Marks will be given according to the University's rule.	

## Attention !!

<b>Mid terms</b>	Teacher will provide the answer scripts and questions. Write <i>Mid term Number, Your Name, Your ID number, Course Code, Course Title, Set and Date</i> on the top page.
<b>Assignment</b>	Teacher will discuss in the class.
<b>Presentation</b>	Your Presentation should have the following sections: (i) Title of the Presentation, (ii) Brief Description, (iii) Discussion (iv) Example (v) Application (vi) Conclusion.

## TEST POLICY

- ✓ If any student is absent from a test that will not be retaken if prior permission is not availed by the student.
- ✓ Zero tolerance to any kind of cheating or adopting unfair means in the exam will be shown.

**GRADING POLICY**

Marks out of 100	Letter	Grade Point
80 - 100	A+	4.00
75 - 79	A	3.75
70 - 74	A-	3.50
65 - 69	B+	3.25
60 - 64	B	3.00
55 - 59	B-	2.75
50 - 54	C+	2.50
45 - 49	C	2.25
40 - 44	D	2.00
00 - 39	F	0.00

**Marks distribution:**

The final course grade will be awarded based on the marks distribution shown in the table above. Percentages of marks for the different heads are given below:

Attendance	05 %
Mid term -1	10 %
Mid term -2	10 %
Assignment	05%
Presentation	10 %
Final Exam	60 %
Total	100%

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