COURSE HANDOUT

MATHEMATICS - III (BSC- 302)

Civil Engineering– 3rd SEMESTER

ACADEMIC YEAR (2024-25)

Dr Ria Gupta

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Department of Civil Engineering

Model Institute of Engineering & Technology (Autonomous)

Kot Bhalwal, Jammu - 181122

www.mietjmu.in

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
BSC-301	Mathematics - III	Core	5	4	1	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Learn the basics of different numerical methods for solving differential equations.
CO2	Explain the concept of Laplace Transform of various functions and its applications and derivatives.
CO3	Use different methods of Inverse Laplace transform to solve ODE and PDE.
CO4	Understand the idea of Fourier series, odd and even functions and its Fourier expansions to solve second order ODEs.
CO5	Apply the concepts of Fourier transform and its properties to solve integral equations and PDEs

Unit-I

Numerical differentiation, numerical integration: trapezoidal rule and Simpson's 1/3rd rule. numerical solutions of algebraic and transcendental equations by regulafalsi, Newton Raphson and direct iterative methods, solution of differential equations by Taylor's method, Picard's method, Euler and modified Euler's methods. Runge-kutta method of fourth order for solving first and second order equations.

(10 Hours)

Unit-II

Laplace transforms: Definition and existence of Laplace transforms, Laplace transform, properties of Laplace transform, unit step function, impulse function, applications to solve initial and boundary value problems. Laplace transform of periodic functions, Laplace transform of derivatives.

(8 Hours)

Unit-III

Inverse Laplace: Definition and existence of inverse Laplace transform Inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, ordinary and higher order differential equations and partial differential equations by Laplace transform methods.

(10 Hours)

Unit- IV

Fourier series: Introduction, Euler's formula, sufficient conditions for a Fourier expansion, functions having points of discontinuity, change of intervals. Odd and even functions and Fourier expansion of odd and even periodic functions, half range series, typical wave forms, Parseval's formula. Power series, solutions of second order ODE.

(11 Hours)

Unit-V

Fourier transform: Fourier integrals, Fourier transform Fourier integral theorem, and their inverses. Properties of Fourier transforms, application of Fourier transform to solve integral equations. Fourier sine and cosine integrals, and their inverses. Solutions of PDEs by Fourier transform.

(8 Hours)

Textbooks

S. No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub. Yr.)
1.	Engineering Mathematics	B.S. Grewal	Khanna Publications, New Delhi	44th (2018)
2.	Engineering Mathematics	N.P. Bali and M. Goyal	Laxmi Publications	10th (2019)
3.	Differential Equations and Laplace Transforms	Veerarajan T	Yes Dee Publishing	1st (2020)

Reference Books

S. No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub. Yr.)
1	Advanced Engineering Mathematics	Kreyszig E.	John Wiley	10th (2011)
2	Engineering Mathematics	Babu R.	Pearson	2nd (2012)
3	Schaum's Outline of Laplace Transforms (Schaum's outlines of theory and problems)	Murray R. Spiegel	Mc Graw-Hill	1st (1965)
4.	Complex Analysis and Numerical Methods	Dr. Bhopinder Singh	Kirti Publishers	2nd (2017)

COURSE PLAN		
Unit-I Numerical differentiation, numerical integration		
S. No	**Topics**	**Recommended Books**
1	Numerical differentiation Numerical integration: trapezoidal rule and Simpson's 1/3rd rule.	Book 1, Ch.8
2	Numerical solutions of algebraic and transcendental equations by regulafalsi	Book 1, Ch.2
3	Newton Raphson and direct iterative methods	Book 1, Ch.2
4	Solution of differential equations by Taylor's method, Picard's method	Book 1, Ch.10
5	Euler and modified Euler's methods	Book 1, Ch.10
6	Runge- kutta method of fourth order for solving first and second order equations	Book 1, Ch.10
Unit-II Laplace transforms		
7	Definition and existence of Laplace transforms, properties of Laplace transform	Book 3, Ch. 1
8	Unit step function, impulse function	Book 3, Ch. 1
9	Applications to solve initial and boundary value problems	Book 3, Ch.1
10	Laplace transform of periodic functions	Book 3, Ch.1
11	Laplace transform of derivatives	Book 3, Ch.1
Unit-III Inverse Laplace Transform		
12	Definition and existence of inverse Laplace transform, Inverse Laplace transform by different methods	Book 3, Ch.1
13	Convolution theorem	Book 3, Ch.1
14	Evaluation of integrals by Laplace transform	Book 3, Ch.1
15	Ordinary and higher Order differential equations by Laplace transform methods	Book 3, Ch.1
16	Partial differential equations by Laplace transform methods	Book 3, Ch.1
Unit-IV Fourier Series		
17	Fourier series : Introduction and Eulers's formula	Book 3, Ch.2
18	Sufficient conditions for a Fourier expansion, functions having points of discontinuity	Book 3, Ch.2
19	Change of intervals	Book 3, Ch.2
20	Odd and Even functions and Fourier expansion of odd and even	Book 3, Ch.2

	periodic functions	
21	Half range series	Book 3, Ch.2
22	Typical wave forms	Book 3, Ch.2
23	Parseval's formula	Book 3, Ch.2
24	Power series	Book 3, Ch.2
25	Solutions of second order ODE	Book 3, Ch.2
Unit-V Fourier transform		
26	Fourier integrals	Book 3, Ch.2
27	Fourier transform Fourier integral theorem, and their inverses	Book 3, Ch.2
28	Properties of Fourier transforms	Book 3, Ch.2
29	Application of Fourier transform to solve integral equations	Book 3, Ch.2
30	Fourier sine and cosine integrals transform and their inverses	Book 3, Ch.2
31	Solutions of PDEs by Fourier transform	Book 3, Ch.2

ADDITIONAL WEB RESOURCES

1.	https://www.digimat.in/nptel/courses/video/111106084/L01.html. This link contains the topic **Analytic Function of complex analysis.**
2.	https://nptel.ac.in/content/storage/111/107/111107105/MP4/mod02lec07.mp4. This link contains the topic **Regular Falsi and Secant methods**.
3.	https://nptel.ac.in/content/storage2/111/106/111106141/MP4/mod04lec14.mp4 This link contains the topic **Mobius Transformation of Complex Analysis**

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Tuesday (12:55 PM - 1:45 PM)
  Wednesday (12:55 PM - 1:45 PM)

- **Contact Information**
  ria.ash@mietjammu.in