

Suggestive readings

1. A.P.Malvino, David J Bates, Electronic Principals, 7th Edition, Tata McGraw-Hill Education, (July 2017).

DISCIPLINE SPECIFIC CORE COURSE – 9: Mathematical Techniques for Instrumentation (INDSC3C)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course(if any)
		Lecture	Tutorial	Practical/ Practice		
Mathematical Techniques for Instrumentation (INDSC3C)	04	03	0	01	Course admission eligibility	Basic knowledge of mathematics

Learning Objectives

The Learning Objectives of this course are as follows:

- To give an ability to apply knowledge of mathematics to engineering problems.
- To introduce the basic concepts required to understand, construct, solve and interpret
- differential equations.
- To teach methods to solve differential equations of various types.
- To teach students to understand the Laplace transform method to solve ordinary differential equations.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Recognize ODEs of varying order and use these to solve engineering problems.
- Derive mathematical models of physical systems.
- Solve the most common PDEs, recurrent in engineering using standard techniques.
- Demonstrate the utility of Laplace transform in solving the ordinary differential equations

SYLLABUS OF DSC-8

UNIT – I

(12 hours)

Ordinary Differential Equations: First Order Ordinary Differential Equations, Separable Ordinary Differential Equations, Exact and Non-Exact Differential Equations, Linear Ordinary Differential Equations. Linear Independence and Dependence, Linear Differential Equations of Second Order with Constant Coefficients and Variable Coefficients: Homogeneous and non-homogeneous. 123

Method of Variation of Parameters, Electric Circuits (RL, RC and RLC circuits).

UNIT – II (11 hours)

Partial Differential Equations: Formation of Partial Differential Equation, Partial Differential Equation of First Order: Linear and Non-linear. Method of Separation of Variables. Classification of Partial Differential Equations of Second Order, One-dimensional Heat equation, Modeling a Vibrating string and the Wave Equation.

UNIT – III (11 hours)

Laplace Transform: Laplace Transform and its properties, Convolution theorem, Laplace Transform of Periodic function, Inverse Laplace transforms and its properties. Application of Laplace Transform to Differential Equations with Constant Coefficients, Solution to System of Simultaneous Differential Equations.

UNIT – IV (11 hours)

Fourier series and Transforms: Fourier Series: Even and Odd functions, Half range expansions, Fourier Integral, Fourier Transforms: Fourier Sine and Cosine Transforms, Forced Oscillations.

Practical component: (30 hours)

1. Plot the trigonometric functions like $\sin(x)$, $\cos(x)$, $\tan(x)$.
2. Plot the following algebraic expressions $\log(x)$, $\exp(x)$, x^2 , x^3 , $x+x^2+\exp(x)$.
3. Plot the following unit step functions $u(t)$, $u(t-4)$ and $u(t+2)$.
4. Solve the first-order ordinary differential equations.
5. Solve the linear differential equation of second order with constant coefficients.
6. Solve the linear differential equation of second order with variable coefficients.
7. Evaluate the Laplace Transform of a given function.
8. Evaluate the inverse Laplace transform of a given function.
9. Evaluate the Fourier series coefficients of a given function.
10. Computing the Fourier Transform of a given signals.

Essential/recommended readings

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition (2020).
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing, 7th Edition.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 43rd Edition (2017).
4. HK Dass, Higher Engineering Mathematics, S.Chand Publishing, 22nd Edition.

Suggestive readings

1. Dennis G.Zill, Advanced Engineering Mathematics, Jones & Bartlett Publishers, 6th Edition (2016).
2. John Bird, Higher Engineering Mathematics, 2017