

DSE-3(iv): Integral Transforms

Weeks 1 and 2: Piecewise continuous functions and periodic functions, Systems of orthogonal functions, Fourier series, Convergence of Fourier series.

[1]: Chapter 6 (Sections 6.1 to 6.5).

Weeks 3 and 4: Examples and applications of Fourier series, Fourier cosine series and Fourier sine series, The Gibbs phenomenon, Complex Fourier series, Fourier series on an arbitrary interval.

[1]: Chapter 6 (Sections 6.6 to 6.9).

Weeks 5 and 6: The Riemann-Lebesgue lemma, Pointwise convergence, uniform convergence, differentiation, and integration of Fourier series; Fourier integrals.

[1]: Chapter 6 (Sections 6.10, 6.11, and 6.13).

Weeks 7 to 9: Fourier transforms, Properties of Fourier transforms, Convolution theorem of the Fourier transform, Fourier transforms of step and impulse functions, Fourier sine and cosine transforms, Convolution properties of Fourier transform.

[1]: Chapter 12 (Sections 12.1 to 12.6, and from Exercises 12.18 [questions 8, and 9]).

Week 10 and 11: Laplace transforms, Properties of Laplace transforms, Convolution theorem of the Laplace transform, Convolution properties of the Laplace transform, Laplace transforms of the Heaviside and Dirac delta functions.

[1]: Chapter 12 (Sections 12.8 to 12.10, and from Exercises 12.18 [question 27]).

[1]: Chapter 11 (Section 11.2 for definition of the Dirac delta function).

[1]: Chapter 12 (Section 12.11 up to Example 12.11.4).

Weeks 12 and 13: Finite Fourier transforms and applications, Applications of Fourier transforms to ordinary differential equations and partial differential equations.

[1]: Chapter 12 (Section 12.15).

[2]: Chapter 2 (Section 2.10, and Section 2.12 [Examples 2.12.1 to 2.12.4, and 2.12.7]).

Weeks 14 and 15: Applications of Laplace transform to ordinary differential equations, partial differential equations, initial and boundary value problems.

[2]: Chapter 4 (Section 4.2 up to Example 4.2.6 [p. 203], and
Section 4.3 up to Example 4.3.6 [p. 231]).

Essential Readings

1. Tyn Myint-U & Lokenath Debnath (2007). Linear Partial Differential Equations for Scientists and Engineers (4th ed.). Birkhauser. Indian Reprint.
2. Lokenath Debnath & Dambaru Bhatta (2015). Integral Transforms and Their Applications (3rd ed.). CRC Press Taylor & Francis Group.