Instructional Objectives for Roberts Chapter 15 –
The Laplace Transform

15.2 Development of the Laplace Transform

Write the equation to compute the Laplace transform of a waveform and its region of convergence (ROC).

Plot the pole-zero plot and ROC of a system using its Laplace transform.

State why the ROC is necessary in computing the Laplace transforms.

Describe the difference between the Laplace transform equation and the Fourier transform equation.

Describe the differences between the unilateral and bilateral Laplace transforms, and for what type of signals/systems they are used.

15.3 Properties of the Laplace Transform

Apply the properties of the Laplace transform to simplify Laplace calculations.

15.4 The Inverse Laplace Transform Using Partial-Fraction Expansion

Given a transfer function, compute its partial fraction expansion.

Given the Laplace transform and ROC of a signal or system, compute the associated waveform or impulse response.

9.5 Laplace Transform-Fourier Transform Equivalence

Determine if the Fourier transform exists for a signal based on the Laplace transform's pole-zero plot.

15.6 Solution of Differential Equations with Initial Conditions

Apply Laplace theory to solve differential equations with or without initial conditions.

15.7 Transfer Functions from Circuit and System Diagrams

For a system, define what is meant by its *transfer function*.

Given a circuit diagram, use Laplace transforms to determine the system transfer function.

15.8 System Stability

State the pole-zero conditions required for a system to be BIBO stable, marginally stable, and unstable.

Given a system's transfer function, determine its pole-zero plot and if the system is stable.

15.9 Parallel, Cascade and Feedback Connections

Given the overall block diagram of a system that includes series and/or parallel connections, and the transfer functions of its subsystems, determine the overall system transfer function.

Determine the transfer function of systems that contain feedback loops.

Given block diagrams of feedback systems, determine the feedback gain necessary to ensure system stability.

15.10 System Responses to Standard Signals

Use Laplace transforms to determine a system's unit step response

15.11 Pole-Zero Diagrams and Graphical Calculation of Frequency Response

Describe how pole and zero placement affects a system's frequency response.