ECEN 3723 Systems I
Spring 2001
Midterm Exam #1

Name: ______________________________

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Problem 1:
Evaluate the following integrals involving delta function:

a) \[ \int_{-\infty}^{\infty} e^{-t} u(\lambda - 2) \delta(\lambda - t) \delta(\lambda - 1) d\lambda \]

b) \[ \int_{-\infty}^{\infty} e^{i\lambda t} \delta\left(\frac{t}{2} - 1\right) dt \]
Problem 2:
(a) Find the Laplace transform of
\[ \cos(t - 2)e^{-t}u(t - 1) \]
(b) Find the Inverse Laplace transform of
\[ \ln \frac{s + a}{s + b} \]
Problem 3:
A continuous-time signal $x(t)$ has the Laplace transform

$$X(s) = \frac{s + 1}{s^3 + 3s^2 - 5s - 7},$$

determine the Laplace transform $V[s]$ for

$v(t) = x(t) \cos 5t$.
**Problem 4:**
Determine the Laplace transform of the following signal, \( x(t) \), with an infinite number of chopped sinusoidal waves.
Problem 5:
A continuous-time system is defined by the following differential equation
\[ \frac{d^2 y(t)}{dt^2} + 5 \frac{d^2 x(t)}{dt^2} - \frac{dy(t)}{dt} + 3y(t) - 2x(t) = 0, \]
where \( x(t) \) is the input and \( y(t) \) is the output of the system. Compute the response, \( y(t) \), for all \( t \geq 0 \), when \( y(0^-) = -2, \dot{y}(0^-) = 1, \) and \( x(t) = r(t) = tu(t) \).