

Control Engineering

Course code: xxxx

Sheet 01 — Laplace Transform

1. Find the inverse Laplace transform for each of the following functions

$$F(s) = \frac{2s + 12}{s^2 + 2s + 5}$$

$$F(s) = \frac{s + 1}{s(s^2 + s + 1)}$$

$$F(s) = \frac{6s + 3}{s^2}$$

$$F(s) = \frac{5s + 2}{(s + 1)(s + 2)^2}$$

2. Solve the following differential equations

a) $2\ddot{x} + 7\dot{x} + 3x = 0 \quad x(0) = 3, \quad \dot{x}(0) = 0$

b) $\ddot{x}(t) + 2\dot{x}(t) + x(t) = 3te^{-t} \quad x(0) = 4, \quad \dot{x}(0) = 2$

c) $\dot{x} + ax = A \sin \omega t \quad x(0) = b$

d) $\ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2x = 0 \quad x(0) = a, \quad \dot{x}(0) = b$

e) $\ddot{y}(t) + 2\dot{y}(t) + 5y(t) = e^{-t}\sin t \quad y(0) = 0 \quad \dot{y}(0) = 1$

f) $\ddot{y}(t) + 2\dot{y}(t) + y(t) = t \quad y(0) = -3 \quad y(1) = -1$