

Instructions. Answer each of the questions on your own paper. Put your name on each page of your paper. Be sure to show your work so that partial credit can be adequately assessed. *Credit will not be given for answers (even correct ones) without supporting work.* A copy of the table of Laplace transforms from the text will be supplied.

1. [20 Points] Compute the inverse Laplace transform of each of the following rational functions.

(a) $F(s) = \frac{2s + 5}{s^2 + 7s + 10}$

(b) $G(s) = \frac{s - 5}{s^2 - 4s + 20}$

2. [20 Points] Use the Laplace transform method to find the solution $y(t)$ of the initial value problem

$$y'' + 2y' + y = 4e^{-t}, \quad y(0) = 0, \quad y'(0) = 1.$$

3. [24 Points] Find the characteristic polynomial and the general solution of each of the following constant coefficient linear homogeneous differential equations:

(a) $3y'' - 5y' + 2y = 0$

(b) $2y'' + 2y' + y = 0$

(c) $y''' + 2y'' + y' = 0$

4. [16 Points] Find the indicial polynomial and the general solution of each of the following Cauchy-Euler equations.

(a) $2t^2y'' + 5ty' - 2y = 0$

(b) $t^2y'' - 3ty' + 4y = 0$

5. [20 Points] Find the general solution of the following differential equation:

$$y'' + 6y' + 8y = 5e^{-2t}.$$

You may use any appropriate method.