CS 333400 - Engineering Mathematics Midterm III @ 12/10/2010

※ 答案紙上需寫下計算過程，否則不予計分。

1. (10%) Solve for the current in the RL circuit if the current is initially zero. The source voltage E(t) is defined as below. (Hint: V=L di/dt)

$$E(t) = \begin{cases} k, & \text{for } 0 \le \mathrm{t} < 5 \\ 0, & \text{for } \mathrm{t} \ge 5 \end{cases}.$$

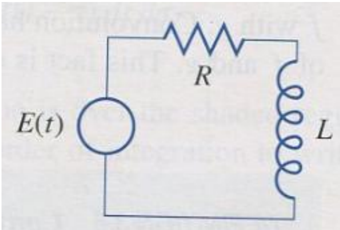



Fig. 1 RL circuit

2. (10%) Use Laplace transform to find the solution *y(t)* of the initial value problem.

$$y^{(3)} - y'' - 4y' + 4y = 1;\ y(0) = y'(0) = 0, y''(0) = 0$$

3. (10%) Solve $f(t)$ in the integral equation using Laplace and inverse Laplace transform.

$$f(t) = 3 + \int_0^t f(\alpha)\cos\left[2(t-\alpha)\right]d\alpha$$

4. (10%) Use Laplace transform to solve x and y.

$$x'' - 2x' + 3y' + 2y = 4,\quad 2y' - x' + 3y = 0,\quad x(0) = x'(0) = y(0) = 0$$

5. (10%) Use Laplace transform to solve the initial value problem.

$$y'' + 2y' + 2y = \delta(t-3),\quad y(0) = 0,\ y'(0) = 0$$

6. (10%) Solve currents $i_1$ and $i_2$ in the circuit in Fig. 2, assuming that the currents and charges are initially zero
and that $E(t) = 2H(t-4) - H(t-5)$.

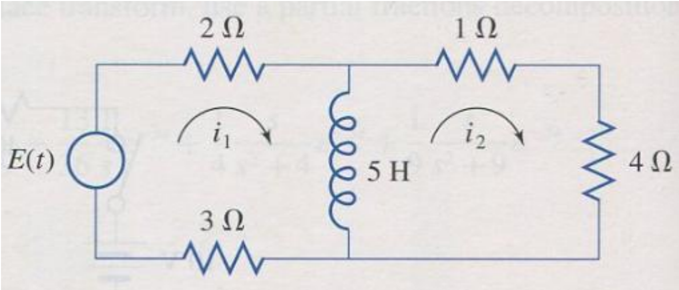



Fig. 2 RL circuit with two loops

7. (10%) Find the first five nonzero terms of the power series solution of the initial value problem, about the point where the initial conditions are given.

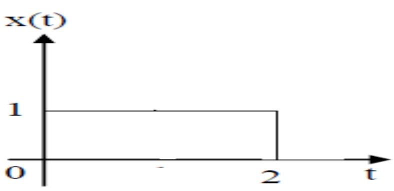
$$y'' - e^x y' + 2y = 1; y(0) = -3, y'(0) = 1$$

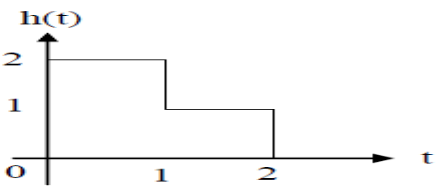
8. (10%) Find the recurrence relation and use it to generate the first five terms of the Maclaurin series of the general solution.

$$y'' + (1 - x)y' + 2y = 1 - x^2$$

9. (10%) Use the Laplace transform to solve problem.
$ty'' + (t-1)y' + y = 0; y(0) = 0$

10. (10%) 已知 $x(t)$ 與 $h(t)$ 如下圖，試求




$x(t) * h(t) = ?$ Also draw the graph of convolution output.