國立嘉義大學 107 學年度

電機工程學系碩士班招生考試試題

科目：工程數學

(注意事項：1.不可使用計算機。　2.依次序作答。)

1. Evaluate the following problems

   (a) Find the inverse Laplace transform of $\dfrac{s}{(s^2+4)(s+2)}$. (5%)

   (b) Find the Laplace transform of $(t-3)^2 u(t-4)$. (5%)

2. Solve $y''-6y'+9y=6x^2+2-12e^{3x}$. (10%)

3. Solve $(xy)dx+(2x^2+3y^2-20)dy=0$. (10%)

4. Solve $(x-2)^2 y''-5(x-2)y'+8y=0,\ y(4)=32,\ y'(4)=0$. (10%)

5. Find the Laplace transform of the periodic function $f(t)$:

   (a) The half-wave rectification of $\sin(\pi t)$ given in Fig. 1(a). (5%)
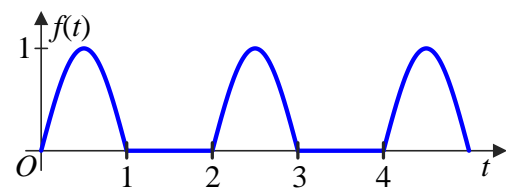   (b) The full-wave rectification of $\sin(\pi t)$ given in Fig. 1(b). (5%)
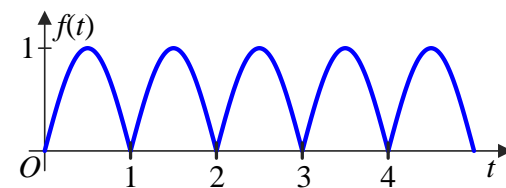

Fig. 1(a)

Fig. 1(b)

6. Expand the function $f(t)=t,\ 0<t<2$ shown in Fig. 2,

   (a) in a Fourier cosine series. (5%)
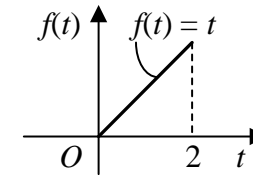
   (b) in a Fourier sine series. (5%)

Fig. 2

7. Calculate the current $i(t)$ of series RL circuit shown in Fig. 3 if the initial current $i(0)=1$A and the impressed voltage is $v_s(t)=V_0[u(t-a)-u(t-b)]$. (Assume $V_0=5$ V, $R=2\ \Omega$, and $L=0.02$ H, $a=2$ sec, $b=4$ sec). Roughly draw the waveform $i(t)$. (10%)
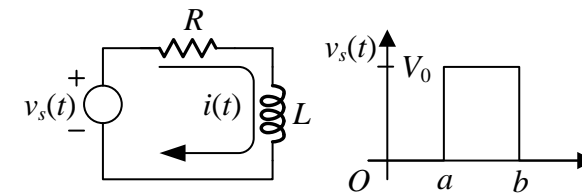

Fig. 3

8. The following system of equations has a unique solution. Solve this system using the method of Gauss-Jordan elimination with matrix. (10%)

$$x_1 - x_2 + 3x_3 = 3$$
$$2x_1 - x_2 + 2x_3 = 2$$
$$3x_1 + x_2 - 2x_3 = 3$$

9. Solve the following system of three equations in three variables by determining the inverse of the matrix of coefficients and then using matrix multiplication. (10%)

$$x_1 + 2x_2 + 3x_3 = 1$$
$$2x_1 + 5x_2 + 3x_3 = 3$$
$$x_1 + 8x_3 = 15$$

10. Determine the eigenvalues of the given 3×3 matrix. (10%)

$$\begin{bmatrix} 3 & 2 & -2 \\ -3 & -1 & 3 \\ 1 & 2 & 0 \end{bmatrix}$$