科目	工程數學	適用系所	電機工程學系電波組、光電組	時間	100 分鐘

※請務必在答案卷作答區內作答。

一、Using **the method of undetermined coefficient** to obtain the solution of the initial value problem. (15%)

$$\frac{d^2y}{dt^2}+12\frac{dy}{dt}+100y = 1.7\sin 2t; \quad y(0) = 5\times10^{-4}, y'(0) = 0.$$

二、Consider the **RLC** circuit, driven by a potential of $E(t)=6sin(2t)$ volts. At time zero the current is zero amperes and the charge on the capacitor is 0.5 coulomb (Figure 1). Find the charge $q(t)$ on the capacitor for $t > 0$, where the $R = 10\Omega$, $C = (1/12)F$, $L = 2H$, by the **Laplace transform relative method**. (20%)
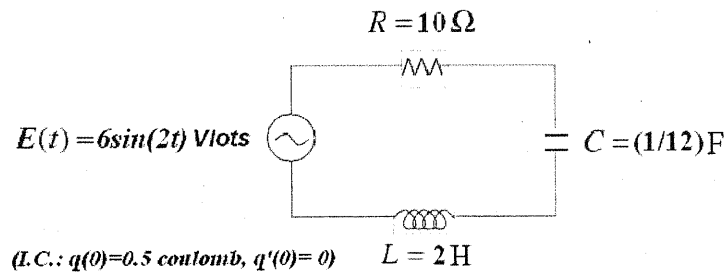
$$R = 10\Omega$$

$E(t) = 6sin(2t)$ Vlots

$C = (1/12)F$

(I.C.: q(0)=0.5 coulomb, q'(0)= 0)　　$L = 2H$

Figure 1

三、To solve the $y(x)$ for the differential equation of $y''+xy'-y = e^{3x}$, the initial condition: $y(0)=a_0$, $y'(0)=a_1$, by using **Power Series relative method**. Find (a) the one-term recurrence relation, and (b) the first seven nonzero items of the power series solution of $y(x)$ at $x = 0$. (15%).

四、Consider $y''+\lambda y=0$ subject the periodic boundary conditions $y(-L)=y(L)$, $y'(-L)=y'(L)$. Find the eigenvalues and the eigenfunctions for the given boundary value problem. (15%)

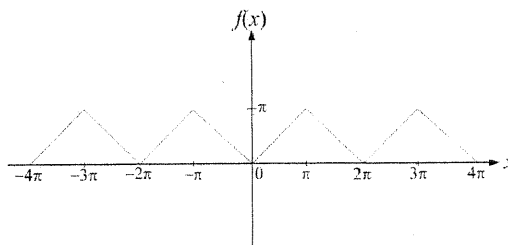五、A triangular wave is shown in figure 2. Find the Fourier series representation of $f(x)$. (15%)

$f(x)$

π

-4π　-3π　-2π　$-\pi$　0　π　2π　3π　4π　x

Figure 2

六、Use the superposition principle to solve Laplace equation $u_{xx}+u_{yy}=0$ for a square plate subject to the following boundary condition. (20%)

$u(0,y)=1$, $u(\pi, y)=1$, $u(x,0)=0$, $u(x,\pi)=1$.