For all homework throughout the semester you must do the following:

1. Explain in your own words what is being asked.
2. State your strategy for arriving at the solution.
3. Execute your strategy noting the steps.
4. ✎ Write legibly and in a logical order.

For each problem, we provide the approximate percentage of points.

Problem 1 [40 %]

Let $x(t)$ be a continuous time real-valued signal that is band-limited to the interval $\left[-\frac{3}{2}\Omega_0, \frac{3}{2}\Omega_0\right]$. Let $T = 2\pi/\Omega_0$. We define

$$y(t) = \sum_{n=-\infty}^{\infty} x(t - nT). \tag{1}$$

1. Prove that
$$y(t) = A + B\cos\left(\frac{2\pi}{T}t + \varphi\right), \tag{2}$$
where A, B and φ are constant that you can express in terms of $X(j\Omega)$, the Fourier transform of $x(t)$. Hint: compute the Fourier transform of $y(t)$, and express it as a function of $X(j\Omega)$.

Problem 2 [40 %]

Let $x(t)$ be an analog signal band-limited to the interval $[-\Omega_0, \Omega_0]$. Let $T = \pi/\Omega_0$. We sample the signal $x(t)$ with the period T and define

$$x[n] = x(nT). \tag{3}$$

We now define

$$y(t) = \sum_{n=-\infty}^{\infty} x[n]\delta(t - 2nT). \tag{4}$$

1. Compute the Fourier transform of $y(t)$ (*note the factor 2 in the Dirac impulse*). Hint: consider the signal $x(t/2)$, and sample it with the appropriate sampling period.
2. Is the signal $y(t)$ aliased? explain mathematically, and physically.

Problems from the textbook [20%]

Solve the following problems from the textbook:

- 4.28
- 4.30
- For graduate students: 4.32