Svar till tentamen i EMI190 Elektriska kretsar och signaler del B 970405

1. (a) $[4(-0.3)^n - 2(-0.4)^n]u[n]$

   (b) $X(j0) = 1$

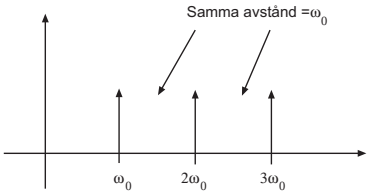
   (c) $y_1(t) \approx 2.6\sin(t - 0.79)$, $y_2(t) \approx 1.4\sin(t + 0.79)$, Kaskad $y(t) \approx 1.8\sin(t)$

   (d) $e^{-j\omega 3} + \frac{1}{(1+j\omega)^2}$

2. 1 – c, 2 – b, 3 – d, 4 – e, 5 – a, 6 – f.

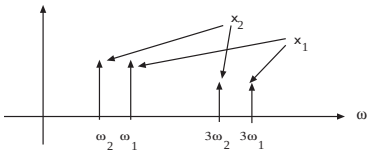
3. (a) $x(t)$ periodisk om $x(t+T) = x_1(t+T) + x_2(t+T) = x_1(t) + x_2(t)$, dvs $T = kT_1 = \ell T_2$ för k, ℓ heltal, dvs $T_1/T_2 = \ell/k$ rationellt.

   (b) Periodisk grundfrekvens $\omega_0 = \frac{2\pi}{T} = \frac{2\pi}{kT_1} = \frac{2\pi}{\ell T_2}$
   $\Rightarrow$ grundfrekvensen finns ej med om $k, \ell > 1$.

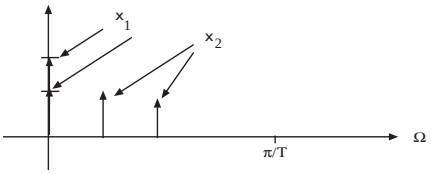


   – aperiodisk – olika avstånd mellan spikarna.

   (c) Efter LP:



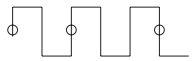
   Sampling:



   Vikningsformeln:

$$X(e^{j\Omega}) = \frac{1}{T_1}\sum_{n=-\infty}^{\infty}\sum_{k=\pm1,\pm3}\frac{4}{jk}\left[\delta\left(\frac{\Omega - 2\pi n}{T_1} - k\omega_1\right) + \delta\left(\frac{\Omega - 2\pi n}{T_1} - k\omega_2\right)\right]$$
$$= \frac{1}{T_1}\sum_{k=\pm1,\pm3}\frac{4}{jk}\left[\delta\left(\frac{\Omega}{2\pi}\right) + \delta\left(\frac{\Omega}{2\pi} + 0.09k\right)\right]$$
$$= \frac{1}{T_1}\sum_{k=\pm1,\pm3}\frac{4}{jk}\,\delta\left(\frac{\Omega}{2\pi} + 0.09k\right)$$

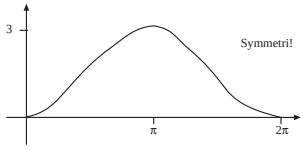
   där $n = -k$ ytnyttjades ty $-\pi \le \Omega < \pi$.



   Bidraget från x_1 försvinner p g a att samplingen sker i dess nollställen. Om signalen tidsförskjuts så försvinner den ej!

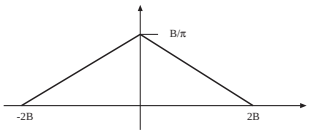
4. (a) $H(z) = 1 - 1.5z^{-1} + 0.5z^{-2}$

   (b) $|\,H(e^{j\Omega})\,| = \sqrt{3.5 - 3\cos(\omega) + \cos(2\omega)}$



   (c) $h[n] = \delta[n] - 1.5\delta[n-1] + 0.5\delta[n-2]$

5. (a) $x^2(t) \quad \curvearrowright \quad \frac{1}{2\pi}X(j\omega) \ \star \ X(j\omega) \quad =$
$\frac{1}{2\pi}\int_{-\infty}^{\infty} X(j\tilde{\omega})X(j(\omega-\tilde{\omega}))d\tilde{\omega} =$
$= \begin{cases} 0 & \text{om} \mid \omega \mid > 2B \\ \frac{2B-\mid\omega\mid}{2\pi} & \text{om} \mid \omega \mid < 2B \end{cases}$



(b) Samplingsfrekvens, x: $\geq B/\pi$, y: $\geq 2B/\pi$