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End Semester Examination, May 2015

M.Tech. (Second Semester)

Department of Electronics and Communications Engineering

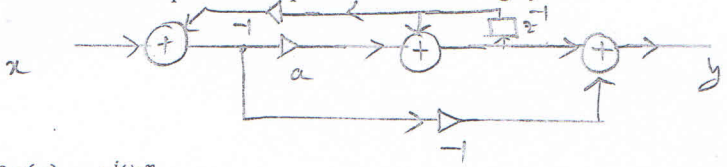
Course Name: Advanced Digital Signal Processing — Maximum Marks: 45

Course Code:10M11EC211 — Duration: Three Hours

Note: Answer all questions.

Section A (Each question is for one mark 10)

1. How do you alter the sampling rate of a given signal?
2. Give the average power of the signal $x(n) = 3(-1)^n\, u(n)$.
3. Give the input-output relation for a 3-point moving average filter.
4. Determine the relation between input and output for the following system.



5. Give the DTFT of $x(n) = e^{j\omega_0 n}$.
6. Give the Parseval's relation for DTFT.
7. What is ROC for the convolution of two signals?
8. Draw the pole-zero pattern for an all pass system.
9. What do you mean by minimum phase function?
10. Give the expressions for group delay and phase delay for a digital system.

Section B (Each question carries five marks)

1. Check the properties of the system $y(n) = \beta + \sum_{l=0}^{3} x(n-l)$, β is non-zero coefficient for linearity, causality stability and time variance.
2. Determine the total response of the system for $n \geq 0$ of the difference equation $y(n) + 0.1\, y(n-1) - 0.06y(n-2) = 2^n\, u(n)$ with initial conditions $y(-1) = 1$ and $y(-2) = 0$ using z-transforms.
3. Let $x(n), 0 \leq n \leq N-1$ be a length N real sequence with $N - point$ DFT $X(k), 0 \leq k \leq N-1$.Show that $X[(N-k)_N] = X^*(k)$. Show that $X(0)$ is real. If N is even, show that $X(\frac{N}{2})$ is real.
4. The frequency response of a length-4 FIR filter with real impulse response has the following specifications. $H(e^{j0}) = 2$, $H(e^{j\pi/2}) = 7 - j3$, $H(e^{j\pi}) = 0$. Determine $H(z)$.

Section C (each question carries five marks)

1. Give a short note on power spectral estimation methods.
2. Give the procedure along with necessary equations to design a Chebyshev IIR high pass filter.
3. Design an aliasing free filter bank for the following QMF filter bank with $H_0(z) = 1$ and $H_1(z) = z^{-1}$.