

EE323 Digital Signal Processing Week 13 Quiz

ACADEMIC YEAR 2019-2020 SEMESTER 1

Name: _____

Date: 4 Dec. 2019

Paper A

Matriculation No: _____

Major: _____

Time Allowed: 50 mins

This Quiz consists of 7 pages and 5 questions

Answer all 6 questions.

Q1-Q5: Short Questions, and 20 marks for each question.

Standard Sequences

- $\delta[n] = 1$ for $n = 0$ and 0 otherwise.
- $\mu[n] = 1$ for $n \geq 0$ and 0 otherwise.

Forward and Inverse Transforms

$$\text{DTFT: } X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x[n]e^{-j\omega n} \quad x[n] = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\omega})e^{j\omega n} d\omega$$

$$\text{DFT: } X[k] = \sum_{n=0}^{N-1} x[n]e^{-j2\pi \frac{kn}{N}} \quad x[n] = \frac{1}{N} \sum_{k=0}^{N-1} X[k]e^{j2\pi \frac{kn}{N}}$$

$$z: \quad X(z) = \sum_{n=-\infty}^{\infty} x[n]z^{-n} \quad x[n] = \frac{1}{2\pi j} \oint_C X(z)z^{n-1} dz$$

Convolution

$$\text{DTFT: } v[n] = x[n] \circledast y[n] \triangleq \sum_{r=-\infty}^{\infty} x[r]y[n-r] \quad \Leftrightarrow \quad V(e^{j\omega}) = X(e^{j\omega})Y(e^{j\omega})$$

$$v[n] = x[n]y[n] \quad \Leftrightarrow \quad V(e^{j\omega}) = X(e^{j\omega}) \circledast Y(e^{j\omega}) = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\theta})Y(e^{j(\omega-\theta)})d\theta$$

$$\text{DFT: } v[n] = x[n] \circledcirc y[n] \triangleq \sum_{r=0}^{N-1} x[r]h[\langle n-r \rangle_N] \quad \Leftrightarrow \quad V[k] = X[k]Y[k]$$

$$v[n] = x[n]y[n] \quad \Leftrightarrow \quad V[k] = \frac{1}{N} X[k] \circledcirc Y[k] = \frac{1}{N} \sum_{r=0}^{N-1} X[r]Y[\langle k-r \rangle_N]$$

Geometric Progression

$$\sum_{n=0}^r a^n z^{-n} = \frac{1-a^{r+1}z^{-r-1}}{1-az^{-1}} \text{ provided that } az^{-1} \neq 1$$

$$\sum_{n=0}^{\infty} a^n z^{-n} = \frac{1}{1-az^{-1}} \text{ provided that } |az^{-1}| < 1$$