EE210 Signals & Systems, Quiz 25% 23rd Oct 2019

Note (a) Read all questions first and ask queries/clarifications soon.
(b) Totally 6 questions, marks distribution at the end.
(c) Assume appropriately & write/justify assumption (if question is unclear)

Q-1: Consider 4-point DFT of $x[0], x[1], x[2], x[3]$.

(a) Show that one can use 2-point DFT appropriately (and thus recursively) to calculate 4-pt DFT.

(b) Find 4-pt DFT of $(x[0], x[1], x[2], x[3]) = (2,3,4,9)$.

Q-2: Show that the matrix F (suitably scaled) that computes the 4-pt DFT of a vector $\begin{bmatrix} x[0] \\ x[1] \\ x[2] \\ x[3] \end{bmatrix}$ is unitary. (i.e. $F^{-1} = F^{*}$, where F^{*} is the complex conjugate transpose)

Q-3 (a) Find the Fourier series of $3\sin 12t + 9\cos 16t$.

(b) Find the Fourier transform of $3\sin 12t + 9\cos 16t$.

Q-4 Prove that the Fourier transform of the impulse train $\sum_{k=-\infty}^{\infty} \delta(t-5k)$ is an impulse train of the form $c_1 \sum_{p=-\infty}^{\infty} \delta(\omega - c_2 p)$. Obtain c_1 & c_2.

Q-5 Suppose $y_1[n]$ has z-transform $Y_1(z) = \dfrac{2}{z+3}$.
Suppose the ROC contains $z=0$.

(a) Obtain $y_1[n]$

(b) Does DTFT of $y_1[n]$ exist? give reasons.

(c) Same as (a) & (b), but for $y_2[n] \longleftrightarrow Y_2(z) = \dfrac{2}{z+3}$ and ROC contains $z=\infty$ (i.e. outside of a disc.)

Q-6 Consider the causal system with input x, output y and transfer function $H(z) = \frac{1}{z(z-2)}$

(a) Find/obtain impulse response $h[n]$.

(b) Is the system stable? Give reasons.

(c) Write the corresponding difference equation governing the system.

—— x —— End of quiz paper ——

Marks total: 40 marks, weightage 25%.

Question	Q1	Q2	Q3	Q4	Q5	Q6
Marks	10	5	5	10	5	5

In proofs, provide intermediate steps/reasons briefly.