International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Special Final Examination Autumn-2018 | Program: B.Sc. Engg. (EEE)
Course Code: EEE 3603 | Course Title: Digital Signal Processing
Time: 2 hours 30 minutes | Full Marks: 50

Part A

[Answer any ***two*** questions from the followings; figures in the right margin indicate full marks.]

1(a). Explain the physical significance of z-transform. 02

1(b). Determine the z-transform of unit step signal. 03

1(c). Show that the z-transform of two different time domain signals may be identical but their ROC's are different. 03

1(d). Determine the pole-zero plot for the signal 02

$$x(n) = a^n u(n),\ a > 0$$

2(a). ...e methods of implementing IIR systems. 02

2(b). Con... ...IR system with system function 04

$$H(z) = 1 + 2.88z^{-1} + 3.4048z^{-2} + 1.74z^{-3} + 0.4z^{-4}$$

Sketch the direct form realization of the system. How many additions and multiplications are required? Determine the number of memory block.

2(c). Explain the cascade form realization of FIR system. Why we factorized the system function into second order polynomial instead of first-order polynomial in cascade realization? 04

3(a). Dete...rse z-transform of

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

for the ROC of (i) $|z| > 1$ (ii) $|z| < 0.5$ and (iii) $0.5 < |z| < 1$

3(b). Determine the cascade realization of the system described by the system function 05

$$H(z) = \frac{10\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{2}{3}z^{-1}\right)(1 + 2z^{-1})}{\left(1 - \frac{3}{4}z^{-1}\right)(1 - \frac{1}{8}z^{-1})\left\{1 - (\frac{1}{2} + j\frac{1}{2})z^{-1}\right\}\left\{1 - (\frac{1}{2} - j\frac{1}{2})z^{-1}\right\}}$$

Part B

[Answer any ***three*** questions from the followings; figures in the right margin indicate full marks.]

4(a). Develop a general expression of linear transformation to compute 4-point DFT of a discrete time sequence. Using this expression, compute the DFT of the following sequence **06**

$$x(n)=\{0,1,2,3\}$$

4(b). Write the mathematical expression of Discrete Fourier Transform (DFT) with the explanation of each symbol. To find the Discrete Fourier Transform, compare the computational complexity of direct DFT with FFT. **04**

5(a). Briefly explain the functions of a digital filter. **03**

5(b). Discuss the disadvantages of digital filter over analog filter. **02**

5(c). What [illegible] of a filter? Explain the ways of converting the kernel of low pass filter into high pass filter. **05**

6(a). Why ideal filter is not physically realizable? **02**

6(b). Explain the relationship between length of filter kernel and roll-off rate. **02**

6(c). Desig[illegible]lter with $\omega p=0.3\pi$ and $\omega s=0.7\pi$ which exhibits a minimum attenuation greater than -50dB in the stop-band. **06**

7(a). Illustrate the basic butterfly computational structure of DIT-FFT algorithm. From this structure determine the number of additions and multiplications required to calculate N-point FFT. **04**

7(b). For t[illegible]time sequence $x(n)=\{1,1,1,0,0,0,0,0\}$, Evaluate the 8-point DFT using decimation in time FFT Algorithm. **06**