PG – 203

III Semester M.Sc. Degree Examination, December 2014
ELECTRONIC SCIENCE
EL – 302 : Digital Signal Processing

Time : 3 Hours Max. Marks : 80

Instructions *: 1) Section-**A** : Answer **all** questions from Section **A**.*
*2) Section-**B** : Answer **any four full** questions from Section **B**.*

SECTION – A **(5×4=20)**

1. Find the Z-transform of positive time exponential sequence.
2. Compute the 4 point DFT of sequence $x(n) = 1^n\ 0 \le n \le 3$.
3. Explain the concept of Power density spectrum.
4. Draw and explain how the order of the filter affects the frequency response of a low pass filter using Butterworth approximation.
5. Explain the concept of Joint time frequency analysis.

SECTION – B

6. a) Determine the step response of a causal LTI system using Z-Transform $y(n) = \alpha y(n-1) + x(n)\ ;\ -1 < \alpha < 1$. **6**

   b) Determine the Z-Transform of the sequence $x(n) = \sin(\omega ni)$. **5**

   c) Find the inverse Z-Transform of $X(Z) = Z^2(1-\frac{1}{2}Z^{-1})\,(1+Z^{-1})\,(1-Z^{-1})$. **4**

7. a) Given $x[n] = [4\ \underset{\uparrow}{3}\ 2\ -1\ 5\ 2\ 3]$.
   Determine :
   i) $y_1[n] = x[2n + 3]$ ii) $y_2(n) = x(-n-3)$. **4**

   b) Given the 2 systems $h_1[n] = [2\ \ 1\ \ 0.5]$ and $h_2[n] = [2\ \ 2\ \ 1\ \ 1]$ are connected in parallel. Determine the output of the system if its input is $x[n] = [1\ \ 2\ \ -2]$. **5**

   c) Write a note on classification of signals with examples. **6**

P.T.O.

8. a) Find DFT of the sequence $x(n) = n + 1 ; 0 \leq n \leq 7$, using FFT algorithm. **10**

   b) Mention the difference between FIR and IIR filter. **5**

9. a) It is required to meet the following specifications of a LPF using Butterworth approximation. Determine the filter coefficients. **10**

   Pass band : $|H(j\Omega)| \geq -2dB ; \quad 0 \leq \omega \leq 0.3\pi$

   Stop band : $|H(j\Omega)| \leq -60dB ; \quad \omega \geq 0.45\pi$.

   b) Determine the digital transfer function using bilinear transformation for the system $H(s) = \frac{2}{s^2 + 3s + 2}$ at (i) T = 1 sec and (ii) T = 0.1 sec. **5**

10. a) Design a high pass filter using the frequency sampling method. The cut off freq. is $\frac{\pi}{4}$. Apply a 8 point rectangular window. **10**

    b) Explain the quantization error. Derive the analytical expression for SQNR. **5**

11. Write short notes on the following : **(3×5=15)**

    a) Properties of DSP Systems

    b) In-place computation

    c) Error sources in spectrum analysis using DFT

    d) Comparison of analog and digital signal processing systems

    e) State and prove the multiplication property of DFT.