(b) Convert the analog filter into digital filter whose system function is $H(S) = \dfrac{S + 0.2}{(S + 0.2)^2 + 9}$. **8**

Use impulse invariance technique. Assume T = 1 sec.

8. (a) Discuss in detail about various window functions for FIR filter design. **12**

(b) Discuss the effect of finite precision arithmetic on digital filters. **8**

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M.E. 1st Semester (Electronics & Communication Engg.)
Examination – January, 2016

ADVANCED DIGITAL SIGNAL PROCESSING
Paper : MEEC-507

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Discuss the following with suitable examples :

   (i) Static and dynamics systems.

   (ii) Stable and unstable systems.

   (iii) Time variant and time invariant system.

   (iv) Linear and non linear systems. 2.5 × 4 = 10

(b) Determine response of following systems to I/P signal

$$x(n) = \begin{cases} |n|, & -3 \leq n < 3 \\ 0, & \text{otherwise} \end{cases}$$

(i) $y(n) = \dfrac{1}{3}[x(n+1) + x(n) + x(n-1)]$

(ii) $y(n) = \displaystyle\sum_{K=-\infty}^{n} x(k) = x(n) + (n-1) + x(n-2)\ldots\ldots$

10

2. Determine Fourier Transform of following signals :

(i) $x(n) = a^{(n)}, -1 < a < 1$

(ii) $x(n) = \delta(n)$

(iii) $x(n) = \left(\dfrac{1}{2}\right)^n u(n-5)$

(iv) $x(n) = \begin{cases} 1 & 0 \leq n \leq 6 \\ 0 & \text{otherwise} \end{cases}$ $5 \times 4 = 20$

3. Using long division, determine the inverse.

(a) Z transform of $X(Z) = \dfrac{1 + 2z^{-1}}{1 - 2z^{-1} + z^{-2}}$.   10

(b) Explain the significance of ROC in Z-transform.   4

(c) State and explain following properties of Z-transform.

(i) Time shifting

(ii) Scaling in z-domain   6

4. Determine the DFT of the sequence :

(a) $x(n) = \begin{cases} \dfrac{1}{4}, & 0 \leq n \leq 2 \\ 0, & \text{otherwise} \end{cases}$ 10

(b) Discuss various properties of DFT.   10

5. Write short notes on :

(i) DIT FFT algorithm

(ii) Circular Convolution   10, 10

6. Draw the structures of cascade and parallel realisations of :

(a) $H(Z) = \dfrac{(1 - Z^{-1})^3}{\left(1 - \dfrac{1}{2}Z^{-1}\right)\left(1 - \dfrac{1}{8}Z^{-1}\right)}$ 10

(b) $H(Z) = \dfrac{\dfrac{Z}{6} + \dfrac{5}{24} + \dfrac{5}{24}Z^{-1} + \dfrac{1}{24}Z^{-2}}{1 - \dfrac{1}{2}Z^{-1} + \dfrac{1}{4}Z^{-2}}$ 10

7. (a) Discuss the procedure of designing IIR filters using bilinear transformation. What is meant by frequency warping ?   12