M.Tech 1st Semester Examination
Jan. 2014
Subject – Advanced Digital Signal Processing
Subject Code – ECL-503

Time Allowed: 03 hours. Maximum Marks: 100

Before answering the question paper the candidate should ensure that they have been supplied the correct question paper. Complaints in this regard, if any, shall not be entertained after the examination.

Note: Question No. 1 is Compulsory and attempt any two questions from each section. All questions carry equal marks.

1. Write the short notes on the following: (4*5 = 20)
   (a) Elliptic Filter
   (b) MDSP
   (c) AR model
   (d) Tunable filter
   (e) DTMF.

SECTION - A
2(a) What are the different methods for designing of IIR digital filter? How is IIR filter designed using bilinear transformation method. (15)
(b) Use the backward difference method for the derivative and convert the analog filter with system function:

\[ H(s) = \frac{1}{s^2 + 16} \]  

(5)

3(a) Why is the Direct form -2 better than Direct form-1? Draw the both forms. (10)
(b) Develop the realization of Direct form-1 & 2 for the difference equation:

\[ y(n) = b_0 x(n) + b_1 x(n - 1) + b_2 x(n - 2) + b_3 x(n - 3) - a_1 y(n - 1) - a_2 y(n - 2) - a_3 y(n - 3). \]  

(10)

4(a) Briefly describe the forward linear prediction. (5)
(b) The second order AR process is given by:

\[ x(n) + a_1 x(n - 1) + a_2 x(n - 2) = w(n) \]

where \( w(n) \) is a white noise process of zero mean and variance \( \sigma^2 \). Determine the conditions required for this AR process to be asymptotically stationary up to order two. (15)

SECTION - B
5. Justify the need of DSP algorithm and explain the following: (10*2 = 20)
   (a) Goertzel algorithm
   (b) Levinson – Durbin algorithm.

6(a) What is FFT architecture? Explain it in detail. (10)
(b) What do you understand by TDM to FDM translator? (10)

7(a) With the help of neat diagram describe the channel vocoder. (10)
(b) How is human speech produced? Discuss its model. (10)