Code No. : 3059

FACULTY OF INFORMATICS

B.E. 3/4 (IT) I Semester (Main) Examination, December 2010

DIGITAL SIGNAL PROCESSING

Time : 3 Hours] [Max. Marks : 75

*Note : Answer **all** questions from Part – A. Answer **any five** questions from Part – **B**.*

PART – A **(25 Marks)**

1. List the advantages of DSP. 3
2. Verify causality and invariance of a system
   $y(n) - 10y(n-1) = 5x(n) + 2x(n-1)$. 2
3. Give the differences and similarities between DIT-FFT and DIF-FFI algorithm. 3
4. What is the significance of Z-transforms in DSP ? 3
5. Give the pole mapping property of impulse invariance. 3
6. What is Gibb's phenomenon ? 2
7. Define limit cycle oscillation. 2
8. Prove the symmetry property of DFT. 3
9. What is a canonical structure ? 2
10. Distinguish between voiced and unvoiced sounds. 2

PART – B **(50 Marks)**

11. a) The discrete time system $y(n) = \alpha\ x(-n)$ where α is a non-zero constant. Determine, whether or not the system defined by the given input-output relationship is

    a) linear b) Casual c) Shift invariant 5

    b) Derive energy density spectrum. 5

12. a) Find the linear convolution of the sequences $x(n) = \{1, 0, 1, 1, 2, 1, -1, 0, 1, 2, 1\}$ and $h(n) = \{1, 2, 1\}$ using overlap add method. 5

    b) Derive the radix-2 DIF-FFT algorithm. 5

13. Design an ideal bandpass filter with a frequency response

$H_d(e^{jw}) = 1$ for $\frac{\pi}{4} \le |w| \le \frac{3\pi}{4} = 0$ otherwise

Using Hamming window for N = 11. **10**

14. Design a Butterworth low pass filter with the specifications $\alpha_p = I$ dB ripple on the pass band $0 \le \omega \le 0.2\pi$ $\alpha_s = 15$ dB in the stop band $0.3\pi \le \omega \le \pi$. Using Impulse Invariance method. **10**

15. a) Explain short-time spectrum analysis. **5**

    b) Give the block diagram of channel vocoder. **5**

16. a) Compute 4-point DFT of a sequence x (n) = {0, 1, 2, 3} using DIT algorithm. **5**

    b) Find the circular convolution of the two sequences $x_1(n) = \{1, 2, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 1\}$. **5**

17. a) Obtain a cascade realization of the following system using first order sections whenever possible $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$. **5**

    b) What are the desirable characteristics of a window ? Why is it necessary for FIR filter design ? **5**