Code No. 3059

FACULTY OF INFORMATICS

B.E. 3/4 (IT) First Semester (Suppl.) Examination, June/July 2011

DIGITAL SIGNAL PROCESSING

Time : Three Hours] [Maximum Marks : 75

Note :— Answer **ALL** questions from Part A. Answer any **FIVE** questions from Part B.

PART—A (Marks : 25)

1. Define and give the different types of filters with waveforms. 3
2. Find the impulse response x(n) of the system

   $y(n) = 0{\cdot}5\ y(n-1) + 6\ y(n-2) + x(n)$. 2
3. Describe the bit-reversal order in DIF FFT and DIT FFT. 3
4. What is zero padding ? How do you convert a linear convolution to circular convolution ? 3
5. What is aliasing effect due to impulse invariant transform ? 2
6. Draw the structure of $H(z) = \dfrac{(0{\cdot}5+2z^{-1})(1+0{\cdot}6z^{-1})}{(z^{-1}+2)(4+z^{-1})}$ using Cascade method. 3
7. Mention the basic principle of FIR digital filters. 3
8. Distinguish between different types of windows. 2
9. What are voiced sounds ? Explain. 2
10. How is speech signal generated ? 2

PART—B (Marks : 50)

11. A second order discrete time system is characterized by the difference equation. Find the impulse response, magnitude and phase response of the given second order system

    $y(n) - 0{\cdot}1\ y(n-1) - 0{\cdot}02\ y(n-2) = 2\ x(n) - x(n-1)$.

    Determine $y(n) \geq 0$ when $x(n) = u(n)$ and the initial conditions are $y(-1) = -10$ and $y(-1) = -5$. 10

12. (a) Determine the response of discrete LTI system if $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{1, 2, 1, 2\}$, using DFT approach. 7

(b) Prove that Parseval's relation for the DFT given by :

$$\sum_{n=0}^{N-1} |x(n)|^2 = \frac{1}{N} \sum_{K=0}^{N-1} |X(K)|^2 .$$ 3

13. (a) Explain the relation between analog and digital filter poles on impulse invariant transform. 4

(b) Convert the following analog filter with transfer function Ha(s) using bilinear transform. Draw the structure of IIR filter :

$$Ha(s) = \frac{0{\cdot}2}{(s+0{\cdot}2)^2 + 16} .$$ 6

14. Design a 5th order band pass linear phase filter for the following specifications. Draw the filter structure :

Lower-cut-off frequency = $0{\cdot}4\ \pi$ rad/sec.

Upper-cut-off frequency = $0{\cdot}6\ \pi$ rad/sec.

Window type = Hamming. 10

15. (a) Write a brief note on channel vocoder. 5

(b) Explain the digital model of speech production with a block diagram. 5

16. (a) Perform the linear convolution of the sequences :

$x(n) = \{-1, 1, 2, -1, 1, 2, -1, 1\}$ and $h(n) = \{2, 3, -2\}$ using overlap-Add method. 7

(b) Define causal, linear and time-variant systems. 3

17. (a) Draw the butterfly structure of 8-point DFT using Radix-2 DIF FFT algorithm. 5

(b) Write a design note on linear face FIR filter using windows. 5