Digital Signal Processing
(EC-308, Dec-2007)

Note: Section A is compulsory. Attempt any four questions from Section-B and any two from Section-C.

Section-A

1. a) What are the constraints on the transfer function if it were to represent a casual LTI system?
   b) What is the relationship between the Z-transform and the discrete Fourier transform?
   c) In what respect does DFT differ from continuous Fourier transform?
   d) Explain the symmetry properties of DFTs which provide basis for fast algorithms.
   e) State the final value theorem of Z-transform.
   f) Mention two symmetry properties of FIR filters for obtaining linear phase.
   g) State the desirable characteristics of windows in the design of FIR digital filters.
   h) What is frequency warping in Bilinear transformation?
   i) What is the difference between Butterworth and chebyshev filters in terms of frequency response.
   j) Explain the concept of pipelining in DSP processor.

Section-B

2. What is the frequency response of a discrete LTI system? Derive the frequency response of a system whose impulse response is given by
   $h(n) = a^n U(n-1)$ for $|a| < 1$

3. Find the inverse of Z-transform of the function. $X(z) = \frac{(z-4)}{(z-1)(z-3)^2}$ for $|z| > 2$
4. draw a 8-point radix-2 FFT DIT flow graph and obtain DFT of the following sequence x(n) =(0, 1, -1, 0, 0, 2, -2, 0)
5. Design flow pass FIR filter using Hamming window to meet the following specifications.
   H (w) = 1 for $0 \le [w] \le \pi/6$
   = 0 for $\pi/6 \le [w] \le \pi$
   Use a 10 tap filter and obtain the impulse response of the desired filter.
6. Which is more sensitive network to finite word length?
   (a) Direct form-II
   (b) Cascade form
   Justify tour answer

Section-C

7. AN IIR low-pass filter is to be designed to meet the following specifications:
   (a) pass-band frequency: 0 to 1.2 k Hz
   (b) Stop band edge: 2 k Hz
   (c) pass-band attenuation ≤ 0.5 db
   (d) stop band attenuation ≥ 15 db

Using butter worth approximation and bilinear transformation obtain the desired IIR digital filter.

8. A LTI system is described by $y(n) = y(n-1) - 0.24\, y(n-2) + x(n)$
   Find the response of this system fo an input of $x(n) = 10 \cos(0.05\pi n)$
9. With the help of a block diagram, explain the architecture of a TMS processor.