SYMBIOSIS INTERNATIONAL UNIVERSITY

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Institute: (0701) SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070121) B.TECH
Electronics & Telecommunication

Batch: 2012-16

Semester: V

Course: Digital Signal Processing

Course Code: 0701210502EC

Date: 10/12/2014 **Maximum Marks:** 75

Day: Wednesday **Time:** 10:00 am - 12:30 pm

Instructions:

1) Use of non- programmable scientific calculator is permitted.
2) Make suitable assumptions wherever required.
3) Draw neat diagrams wherever required.
4) Part A is compulsory.
5) Answer any 5 questions out of 6 questions in Part B.

Part A

Q.1 a) Compute 4 point DFT of the sequence $x(n)= \sin(n\pi/4)$ **3**

b) Compute 5 point circular convolution of two DT signals defined as, **4**

$$x(n)= (2)^n \quad 0\le n\le 2$$
$$h(n)= 2n-1 \quad 0\le n\le 3$$

c) How can the transition bandwidth of the FIR filter be reduced in design using windows? Explain it for different window functions. **3**

d) Obtain the expression for output y(n) for given multirate system. **3**

$$x(n) \rightarrow \boxed{\uparrow 4} \rightarrow \boxed{\downarrow 12} \rightarrow \boxed{\uparrow 3} \rightarrow y(n)$$

e) Convert the analog filter with system function **3**

$H(s) = \dfrac{s+0.1}{(s+0.1)^2+9}$ into a digital IIR filter using impulse invariant technique. Assume T= 0.5s.

f) Justify the necessity of MAC in DSP processor. **2**

g) What is meant by fixed point and floating point DSP processor? **2**

h) Obtain the direct form II and cascade structures for the following system. **5**
$y(n) = -0.1y(n-1)-0.72y(n-2)+0.7x(n)-0.2x(n-2)$

Part B

Q.2 a) Draw the flow graph for the implementation of 8 point DIF FFT of the following sequence. **8**

$x(n) = \cos(n\pi/2)$

b) Give the computational efficiency of FFT over DFT. **2**

Q.3 Using impulse invariant transformation convert the following analog filter transfer function to digital filter function by taking sampling time ,T=0.5s **10**

$$H(s) = \frac{2.8s^2+4.8s+2.9}{(s+3)(s^2+s+0.85)}$$

Q.4 a) Design a normalized linear phase FIR filter having the phase delay τ=3 and at least 44 dB attenuation in the stopband. Assume cut off frequency of $\pi/4$ rad/sec. **8**

b) Compare FIR and IIR filter. **2**

Q.5 a) Design a two stage decimator with down sample factor of 96 with following specifications.(Assume M_1= 16 and M_2 =4) **6**

Fs= 3.2MHz

Highest Frequency of interest in data= 20KHz

Passband ripple=0.01dB

Stopband ripple= 20dB

b) Explain the application of multirate DSP in speech processing for sub band coding. **4**

Q.6 a) FIR digital filter has the unit impulse response sequence h(n) ={1,2,2}.Determine the output sequence in response to the input sequence x(n) = {2,1,0,-2,0,2,1,-2,2,1} using overlap-save method. **6**

b) Determine the parallel form realization of the given IIR digital filter transfer function **4**

$$H(z) = \frac{3(2z^2+5z+4)}{(2z+1)(z+2)}$$

Q.7 a) Explain the various ways of fast computation in DSP processor. 4

b) Draw the architectural block diagram of TMS320C54x processor. 4

c) State the features of TMS320C54x processor. 2