# BITS, PILANI – DUBAI CAMPUS

**Knowledge Village, Dubai**
**Year IV – Semester II 2006– 2007**
**Comprehensive Examination (Closed Book)**

**Course No.: EEE UC 415** **Course Title: DSP**

**Date: May 20th , 2007** **Time: 3hrs.** **Max. Marks = 40**

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( Answer all questions)

1. The A/D converter used in a digital system is 8 bit and the quantized signal is processed by a first order IIR digital filter whose transfer function is given by $H(z) = z / ( z - 0.92 )$. Find the steady state noise power due to quantization that occur at the output of H(z). (5M)

2. The frequency response specification for a band-pass discrete-time filter in normalized form is as follows.
   Pass-band : $0.4\pi$ - $0.6\pi$ ;
   stop-bands: $0 - 0.3\pi$ and $0.7\pi$ - $\pi$ .
   Sampling interval T= 100us
   a) Express the specifications in rad/s ( de-normalised)
   b) Convert the specs from rad/s to standard units of Hz
   c) Convert the specs to normalized frequency form
   d) Sketch the frequency response for (b) in the interval from 0 to sampling frequency. (8M)

3. Obtain the transfer function of a simple low pass discrete-time filter with the following specifications.
   Cut-off frequency: 1KHz, Sampling frequency: 8KHz
   Specify and sketch a suitable pole-zero diagram of the filter. Determine the amplitude and phase response at 1KHz, 2KHz and 4KHz. Sketch the amplitude response of the filter. (6M)

4. Obtain the coefficients of an FIR low pass digital filter to meet the specifications below using window method.
   Pass-band edge frequency : 3.4 KHz
   Transition width : 0.6KHz
   Sampling frequency : 8 KHz
   Give your comments on the window used and the reason for your choice. (5M)

5. Consider an audio band signal with a nominal band width of 3 KHz that has been sampled at a rate of 6 KHz. It is required to down rate the sampling frequency to 200 Hz. The highest frequency of interest after decimation is 75 Hz. Design a suitable optimum two stage decimator which will satisfy the following overall specifications.

   Pass band ripple = 0.01; Stop band ripple = 0.001
   Filter length $N = \frac{-10 \log ( \delta_s \delta_p ) - 13}{14.6\, \Delta f} + 1$ ;
   where $\Delta f$ is the normalized frequency.

   Draw also the frequency response of the designed decimator stages. (8M)

( contd. in page2 )

6.1. The addressing mode that is convenient for FFT computation is
a) indirect addressing b) circular mode
c) Bit reversed addressing d) Memory mapped

6.2 The _____ holds the result of multiplication and is _____ bit wide
a) Preg, 32 b) Treg, 32 c) Acc, 32 d) Preg, 16

6.3 The bit of ST1 used for comparing one register against another register memory is
a) SXM b) OV c) TC d) C

6.4 The memory mapped direct addressing mode is used to access data in page_____
a) 1 b) 0 c) 511 d) 512

6.5 The two special purpose memory mapped registers in the CPU are _____ and _____

6.6 Name the memory mapped registers that control the circular buffer operation.

6.7 In the direct addressing mode of C5X _____ bits of the address is specified in the instruction and _____ bits are taken from the DP

6.8 The starting address of the data memory page pointed by the DP register whose content is 7 will be _____

6.9 When MACD instruction is executed, the product register is shifted by the count specified by the _____

6.10 For all the multiplication instructions of C5X, one of the operands is to be kept in _____ and the other can be specified by using one of the addressing modes.

6.11 The data memory used with C5X processor is split into _____ pages each of _____ words long.

6.12 What addressing mode is represented by the syntax *0+

6.13 What is the syntax for long immediate addressing? explain an example?

(0.5 x 10 + 1 x 3 =8M )

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BPDC, knowledge village, DUBAI

II nd semester 2006-2007

Digital Signal processing – EEE UC415

Test-1 – 25-02-07.

Duration: 50min: Weightage – 15% : Max: Marks: 30.

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Q1. Design a chebyshev filter of Type I which has a ripple in the pass band 3dB and stop band attenuation of atleast 16dB at twice that of the pass band cut-off frequency. The pass band cut off frequency is 1 KHz. Determine the poles of the filter and hence the transfer function. (10)

Q2. Design a band stop Butterworth filter to meet the following specifications.

(i) stop band : 100 to 600 Hz

(ii) 20 dB attenuation at 200 and 400 Hz

(iii) The gain at $\omega = 0$ is unity.

(iv) The pass band attenuation is 3dB. (10)

Q3.(a) Find the poles and zeros of the transfer function given below and sketch the pole-zero diagram

$$H(z) = \frac{1 - z^{-1} - 2z^{-2}}{1 - 1.75z^{-1} + 1.25z^{-2} - 0.375z^{-3}}$$ (3)

Also write the difference equation of the system (2)

(b) Given $H(z) = \frac{z+1}{z - 0.707}$. Find the frequency response at dc, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ Sampling frequencies (5)