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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; Dec - 2016/Jan - 2017

Digital Signal Processor and its Applications

Time: 3 hrs *Max. Marks: 100*

Note: i) *Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) *Missing data, if any, may suitably assume.*

UNIT - I

1 a. Give the structure of a 4 x 4 Braun multiplier, explain its concept. What modification is required to carry out multiplication of signed numbers? Comment on the speed of the multiplier. 10

b. Explain MAC unit and guard bits in a MAC unit of DSP. Consider a MAC unit whose inputs are 24 bit numbers. How many guard bit should be provided, if 512 products have to be added in the accumulator to present overflow condition? What is the overall size of the accumulator required? 10

2 a. What is the role of a shifter in DSP? With neat diagram explain implementation of 4-bit shift right barrel shifter. Also compute the number of control lines required to implement the barrel shifter with 16 inputs for left shifts from 0 to 15 bits. 10

b. Mention the features of DSP hardware architecture that facilitate high speed of operation and large throughputs. Explain how these features can increase the extension speed of the DSP architecture? 10

UNIT - II

3 a. Describe any four addressing modes of TMS320C54XX DSP processor. 8

b. Write an assembly language program of TMS320C54XX processor to compute the sum of three product terms given by,

$$y(n) = h(0)x(n) + h(1)x(n-1) + h(2)x(n-2)$$

Using the MAC instruction. 6

c. Assuming the current contents of AR3 to be 200h, what will be its contents after each of the following TMS320C54XX addressing modes is used? Assume that the contents of AR0 are 20h 6

* AR3 * AR3+0 *+ AR3(40h)

4 a. Describe the pipeline operation of TMS320C54XX processor. Also show the pipeline operation of the following sequence of instructions, if the initial value of AR3 is 80 and the values stored in memory location 80, 81 and 82 are 1, 2 and 3 respectively. 12

LD * AR3+, A
ADD # 1000h, A
STL A, * AR3+

b. Draw the neat functional diagram of barrel shifter of TMS320C54XX processor and explain its functioning. 8

UNIT - III

5 a. Describe the importance of Q-notation in DSP algorithm implementation. What values are represented by 16 bit fixed point numbers? 8

i) 12464H ii) EDBAH in Q15 and Q7 notations?

b. Explain with an example decimation and interpolation process. Discuss why interpolation process is generally followed by a low pass filter and decimation process is generally preceded by a low pass filter. 12

6 a. Explain adaptive filtering process with a neat block diagram. Develop an adaptive filtering system for the noise cancellation application using second order FIR filter, if the primary Input signal is $d(n) = \left[\underset{\uparrow}{3}, 2, -1 \right]$, secondary input signal is $x(n) = \left[\underset{\uparrow}{1}, 1, -1 \right]$ and the coefficient of adaptation is M = 0.1. Compute filter weights for two iteration. 12

b. Show low overflow conditions are avoided by scaling process before computing the butterfly in a FIT algorithm. 8

UNIT - IV

7 a. Design a data memory system with address range 000800h-000FFFh using 2k x 8 SRAM memory chips. Justify your design. 10

b. What are the interrupts and mention the classes of interrupts available in JMS320C54XX Processors writing the flowchart, explain the handling of interrupts by the processor. 10

8 a. What do you mean by DMA? Discuss how DMA operation is configured? 6

b. Highlight the features of multichannel Buffered serial port. 4

c. Explain PCM 3002 codec with the help of neat block diagram. 10

UNIT - V

9 a. With the help of block diagram, explain with image compression and reconstruction using JPEG encoder and decoder. 10

b. Discuss the use of DSP device in position control system of hard disk drive with neat block diagram. Also discuss an adaptive scheme for head positioning in the presence of environmental variations. 10

10 a. Discuss the autocorrelation based pitch detection scheme with neat block diagram. 10

b. With neat block diagram, explain the DSP based bio elementary receiver system using pulse position modulation scheme for encoding and decoding two biomedical signals. 10

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