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Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
DSP Algorithms and Architecture

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1 a. An analog signal is sampled at the rate of 8KHz. If 512 samples of this signal are used to compute DFT $x(k)$, determine analog and digital frequency spacing between adjacent $x(k)$ elements. Also, determine analog and digital frequencies corresponding to $k = 64$. (06 Marks)
- b. With a neat block diagram, explain scheme of a DSP system. (08 Marks)
- c. Let $x[n] = [3, 2, -2, 0, 7]$. It is interpolated using an interpolation filter $b_k = [0.5, 1, 0.5]$ with interpolation factor 2. Determine the interpolated sequence. (06 Marks)
- 2 a. With a neat block diagram, explain arithmetic logic unit (ALU) of a DSP system. (06 Marks)
- b. Explain the operation of barrel shifter, with an example. (05 Marks)
- c. Explain : i) circular addressing mode ii) parallelism iii) Guard bits. (09 Marks)
- 3 a. Explain functional architecture of TMS320C54XX processor, with a block diagram. (10 Marks)
- b. Explain the addressing modes of TMS320C54XX processor. Give examples. (10 Marks)
- 4 a. Explain the following assembler directives of TMS320C54XX processors.
i) `·mmregs` ii) `·global` iii) `·include'xx'` iv) `·data` v) `·end` vi) `·bss` (06 Marks)
- b. Describe Host port interface and explain its signals. (06 Marks)
- c. Write an assembly language program of TMS320C54XX processors to compute the sum of three product terms given by the equation, $y(n) = h_0 x(n) + h_1 x(n-1) + h_2 x(n-2)$ with usual notations. Find $y(n)$ for signed 16 bit data samples and 16 bit constants. (08 Marks)

PART – B

- 5 a. Determine the value of each of the following 16-bit numbers represented using the given Q-notations: i) 4400h as a Q0 number ii) 4400h as a Q7 number iii) `·3125` as a Q15 number iv) `–·3125` as a Q15 number. (06 Marks)
- b. Write an assembly language program for TMS320C54XX processors to multiply two Q15 numbers to produce Q15 number result. (06 Marks)
- c. What is an interpolation filter? Explain the implementation of digital interpolation using FIR filter and polyphase subfilter. (08 Marks)
- 6 a. Write a TMS320C54XX program that illustrates the implementation of 8-point DIT FFT algorithm. (12 Marks)
- b. Briefly explain scaling and derive the expression for optimum scaling factor for DIT FFT Butterfly algorithm. (08 Marks)
- 7 a. With a neat schematic diagram, design a data memory system with address range 000800h – 000FFFh for a C5416 processor. Use 2K×8 SRAM memory chips. (08 Marks)
- b. Explain how the interrupts are handled in TMS320C54XX processor, with the help of a flow chart. (08 Marks)
- c. Explain briefly memory space organization in TMS320C54XX memory. (04 Marks)
- 8 a. Explain PCM3002 CODEC, with the help of a neat block diagram. (06 Marks)
- b. Explain DSP-based biotelemetry receiver system, with the help of a block schematic diagram. (06 Marks)
- c. With the help of a block diagram, explain the image compression and reconstruction using JPEG encoder and decoder. (08 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.