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10EC751

**Seventh Semester B.E. Degree Examination, Feb./Mar. 2022**  
**DSP Algorithms and Architecture**

Time: 3 hrs.

Max. Marks:100

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

**PART – A**

- 1 a. An analog signal is sampled at the rate of 8KHz. If 512 samples of signals are used to compute DFT  $X[k]$ , determine the analog and digital frequency spacing between adjacent  $X[k]$  elements. Also, determine analog and digital frequencies corresponding to  $k = 64$ . (06 Marks)
- b. Explain the need of decimation and interpolation in DSP systems. (06 Marks)
- c. Find the interpolated sequence, if  $x(n) = (0 \ 3 \ 6 \ 9 \ 12)$ ,  $b_k = \left[ \frac{1}{3}, \frac{2}{3}, 1, \frac{2}{3}, \frac{1}{3} \right]$  and interpolation factor is 3. (08 Marks)
- 2 a. What is the need of shifter in DSP? Explain the implementation of 8-bit right shift barrel shifter with a diagram. (12 Marks)
- b. Explain special addressing modes with neat diagrams. (06 Marks)
- c. The 256 products of 16-bits are to be summed up in a MAC unit, how many guard bits should be provided to prevent overflow? (02 Marks)
- 3 a. Draw and explain the functional diagram of multiplier/adder unit of TMS320C54XX processors. (06 Marks)
- b. With a neat block diagram, explain direct addressing mode for TMS320C54XX. (06 Marks)
- c. Draw a neat diagram for page 0 of program and data memory in microprocessor and micro computer mode. (08 Marks)
- 4 a. Explain the operation of the following instructions of TMS320C54XX processor  
i)  $MPY[R] S_{mem}, dst$   
ii)  $MACD S_{mem}, pmad, src$   
iii)  $MAS X_{mem}, Y_{mem}, src, dst$   
iv)  $LD S_{mem}, 16, dst$ . (08 Marks)
- b. 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, 82 are 1, 2 and 3  
 $LD \ *AR3+, A$   
 $ADD \ \# 1000H, A$   
 $STL \ A, *AR3+$  (06 Marks)
- c. Describe the operation of hardware timer with neat diagram. (06 Marks)

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.

## PART – B

- 5 a. Obtain decimal value of the following  $Q_{15}$  numbers :
- i) 8D1CH
  - ii) 0D67H
  - iii) D0B5H
  - iv) FFFFH
  - v) 4E68H.
- b. Explain with a neat diagram, equations, algorithm and program for FIR filter implementation using TMS320C554XX processor. (10 Marks)
- 6 a. Explain overflow and scaling in butterfly computation. (06 Marks)
- b. Derive scaling factor for DIF FFT butterfly structures. (06 Marks)
- c. Draw 8-point DIT FFT structure with scaling factor. (08 Marks)
- 7 a. Design a data memory system with address range 000800H – 000FFFH for a TMS320C5416. Use  $2K \times 8$  RAM memory chips. (10 Marks)
- b. With a neat flowchart explain the response of digital signal processor for input/output in interrupt mode. (10 Marks)
- 8 Write short notes on :
- a. DSP based telemetry receiver
  - b. Codec Interface
  - d. Speech Processing System
  - c. Image Processing System. (20 Marks)

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