

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.



10TE74

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021

## DSP Algorithm 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. Explain a digital signal processing system with the help of a block diagram. (06 Marks)  
b. Explain the decimation and interpolation process with an example. (08 Marks)  
c. An analog signal is sampled at the rate of 8 kHz. If 512 samples of this signal are used to compute the Fourier transform  $X(K)$ , determine the frequency spacing between adjacent  $X(K)$  elements. Also, determine the analog frequency corresponding to  $K = 64, 128$  and  $200$ . (06 Marks)
2. a. Explain different methods of handling overflow in DSP. (08 Marks)  
b. Explain the working of program sequence unit of programmable DSP. (06 Marks)  
c. Show the multiplication of signed numbers with example in DSP processor. (06 Marks)
3. a. Describe the multiplier/adder unit of TMS320C54XX processor with a neat block diagram. (06 Marks)  
b. Describe any four data addressing modes of TMS320C54XX DSP with examples. (08 Marks)  
c. Assume the current contents of AR3 to be 400h, what will be its contents after each of the following TMS320C54XX addressing modes is used? Assume that the contents of ARO are 40h.  
i)  $*AR3+0$ ;                      ii)  $*AR3+$ ;                      iii)  $*AR3+OB$  (06 Marks)
4. a. Explain the six-stage pipeline structure of TMS320C54XX execution. (08 Marks)  
b. Write about the different types of serial ports available on C54XX devices. (06 Marks)  
c. What will be the contents of the following, after the execution of the instruction:  
MACD  $*AR3_$ , COEFFS, A.  
All the values are in hexadecimal.  
A : 00                      0077                      0000  
T :    0008  
FRCT :    0  
AR3 :    0100  
Program memory  
Coeffs :    1234  
DATA memory  
0100h :    0055  
0101h :    0060 (06 Marks)

### PART – B

5. a. Describe the importance of Q notation in DSP.  
Represent the following numbers in desired Q-notation 0.3125 as  $Q_{15}$  number, -0.3125 as  $Q_{15}$  number & 3.125 as  $Q_7$  number, 4000h as  $Q_{15}$ ,  $Q_7$  and  $Q_0$  number. (10 Marks)  
b. How is the decimation filter implemented in TMS320C54, write ALP for the same. (10 Marks)

- 6 a. Sketch a signal flow graph for general butterfly computation. (04 Marks)  
b. Derive expressions for computation of outputs of the butterfly sketched in Q6(a). (06 Marks)  
c. Determine the optimum scaling factor to prevent overflow. (10 Marks)
- 7 a. Explain DMA with respect to TMS320C54XX processor. (08 Marks)  
b. With neat sketches, explain the memory space organization of TMS320C5416 processor. (08 Marks)  
c. For a C5416 processor with 23 bit address lines, the least 13 bits are used to interface an external program memory. How many address ranges exist for each location to access this external program memory? (04 Marks)
- 8 a. Explain JPEG encoding and decoding with the help of block diagram. (08 Marks)  
b. Write a brief note on pitch period estimation. (06 Marks)  
c. Explain the DSP based Bio-Telemetry Receiver. (06 Marks)

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