

Reg. No.: 21BCE1846

Name : Vishal



**VIT**  
Vellore Institute of Technology  
(Deemed to be University under section 3 of UGC Act, 1956)

CAT-1 JAN-2023

Programme	: B. Tech Computer Science and Engineering	Semester	: WIN 2022-23
Course Code	: BCSE205L	Class Nbr(s)	: CH2022235000637 CH2022235000642 CH2022235000645 CH2022235000648 — CH2022235000651 CH2022235000652
Course Title	: Computer Architecture and Organization		
Faculty(s)	: Dr. A. K Ilavarasi, Dr. Manas Ranjan Prusty, Dr. Bhanu Chander Balusa, Dr. Asha Jerlin M, Dr. Anushiya Rachel, Dr.R.V.Aswiga	Slot	: D1 + TD1
Date & Time	: 25-1-2023 & 9 AM to 10.30 AM	Max. Marks	: 50

Q. No.	Sub-division	Question Text	Marks
1.		Assume that the main memory is divided into locations numbered from (row) 0: (column) 0 to (row) 5: (column) 3 and there are six registers namely U, V, W, X, Y, Z. The execution unit can only operate on data that has been loaded into one of the six registers. Let's say we want to find the product of two numbers - one stored in location (row)1: (column)2 and another stored in location (row) 4: (column)1 - and then store the product back in the location (row)1: (column) 2.	
	i)	Complete a task in few lines of assembly code or with a specific instruction. Justify how it operates directly on the computer's memory banks and does not require the programmer to explicitly call any loading or storing functions. (3 marks)	
	ii)	In order to perform the exact task, use only simple instructions that can be executed within one clock cycle. (3 marks)	
	iii)	Build appropriate architecture of above two processors in a neat sketch and explain its merits and demerits. (4 marks)	10
2.	i)	Identify the type of processor that uses instruction buffer register to hold temporarily the instruction from a word in memory. Justify the use of instruction buffer register in processor with neat labelled structure. (5 marks)	
	ii)	The above processor is used to multiply two numbers 5 and 12, present in the main memory location 3000 and 4000 respectively. The assembly code is given below in the table along with	10

+4 + 2



the address at which it is stored in the memory. Assume each instruction is 20 bits long and each address location is 40 bits long.

Address	Mnemonics	Comment
500	LDA 3000	Load accumulator with the content of memory location 3000
	MOV B, 4000	Copy content of the memory location 4000 to register B
501	MUL B	Multiply the content of accumulator with register B and store it in accumulator
	STA 5000	Store content of accumulator to memory location 5000

Trace the content of the Program counter, Memory address register, Memory buffer register, Instruction register, Instruction buffer register and Accumulator for the given code. (5 marks)

3. An 8 litres jar filled with kerosene was poured to a big keg for 13 times. A part of a processor module uses the modified version of the Booth's algorithm to perform this operation. With respect to this algorithm, answer the following

- Show the step-by-step process used in this algorithm. (7 Marks)
- Validate the correctness of the result in both binary and decimal format. (3 Marks)

4. Consider a 16-bit, floating-point number with a sign bit, a 6-bit exponent and a 9-bit mantissa fraction. The base of the scale factor is 2 and the exponent is represented in excess-31 format.

A =	0	100001	111111110
B =	0	011111	001010101

- Represent the numbers correctly and perform Addition on the two numbers A and B and give the answer in normalized form. (5 Marks)
- Perform multiplication on the two numbers A and B and give the answer in normalized form. (5 Marks)

5. A company wants to manufacture a device that calculates the sum of the volume of a sphere and volume of a cylinder. Assume, the radius of the sphere and the cylinder is same and stored in a register R and the height of the cylinder is stored in a register H.

Hint: Volume of a sphere =  $\frac{4}{3}\pi R^3$  and Volume of a cylinder =  $\pi R^2 H$

Represent the task clearly and device an assembly code using 0-address, 1-address and 2-address instruction format that does this task. Explain each instruction clearly to achieve the final result. (10 marks)

$$\begin{array}{r} 128 \\ 128 \\ \hline 256 \end{array}$$

25A

510