

## A4-R4: COMPUTER SYSTEM ARCHITECTURE

### NOTE:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FOUR** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

**TOTAL TIME: 3 HOURS**

**TOTAL MARKS: 100**  
**(PART ONE – 40; PART TWO – 60)**

### **PART ONE** **(Answer all the questions)**

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one and enter in the “tear-off” answer sheet attached to the question paper, following instructions therein. (1x10)**
  - 1.1 Which of the following is NOT the key distinguishing feature of a microprocessor
    - A) Clock Speed
    - B) L1 Cache
    - C) Number of transistors
    - D) Capacity of the Hard Disk
  - 1.2 The two's complement of binary number 11001 is
    - A) 00111
    - B) 00110
    - C) 11000
    - D) 11001
  - 1.3 How many binary digits are added by a full adder
    - A) 12
    - B) 3
    - C) 4
    - D) 2
  - 1.4 A NOR gate is ON only when all its inputs are
    - A) ON
    - B) Low
    - C) Oscillating
    - D) OFF
  - 1.5 A disk pack contains 6 disks. Data can be read/written from both the surfaces of the disk. There are 200 tracks on each disk surface, each track is divided into 50 sectors and each sector contains 512 bytes. What is the total storage capacity of the disk pack (in bytes)?
    - A) 512X50X200X12
    - B) 512X50X200X10
    - C) 512X50X200X6
    - D) (512X50X200X6)/2

- 1.6 The number of input words in a truth table always equals \_\_\_\_\_, where n is the number of input bits
- A)  $10^n$
  - B)  $2^n$
  - C)  $4^n$
  - D)  $8^n$
- 1.7 Which of the following semiconductor memory is used for cache memory?
- A) SRAM
  - B) DRAM
  - C) ROM
  - D) PROM
- 1.8 The result of adding numbers -7 and 5 in two's complement representation is
- A) 1110
  - B) 1010
  - C) 1001
  - D) 1100
- 1.9 The meaning of the instruction ISZ X (increment and skip if zero) is
- A) Increment the content of accumulator by one, if it is zero then skip to the location X.
  - B) Increment the locations X by one if it is zero then skip the next instruction
  - C) Increment the content of location X by one, if the result is zero, skips the next instruction.
  - D) None of these
- 1.10 In which addressing mode the operator is included in the instruction format
- A) Indirect Addressing
  - B) Direct Addressing
  - C) Immediate Addressing
  - D) Indexed Addressing

2. Each statement below is either TRUE or FALSE. Choose the most appropriate one and ENTER in the “tear-off” sheet attached to the question paper, following instructions therein. (1x10)

- 2.1 In boolean algebra,  $A.A=A^2$ .
- 2.2 A decimal 92 is the equivalent of an octal 5C.
- 2.3 Multiplexer is a circuit which receives binary information from one of the multiple input lines and passes it to the single output line.
- 2.4 Programmed I/O is more efficient than the interrupt driven I/O.
- 2.5 In paged memory it is necessary that the pages of a process are loaded contiguously in the main memory.
- 2.6 The arithmetic shift treats the data as signed integer and does not shift the sign bit.
- 2.7 Simplified expression for the boolean expression  $A'B+ABC'+ABC$  is B.
- 2.8 The logic circuit for a half adder consists of an OR and an AND gate.
- 2.9 The conditional control statement if (P=1) then (R1 <-- R2) else if (Q=1) then (R1 <-- R3) can be represented by two register transfer statements  

$$P: R1 \leftarrow R2$$

$$P'Q: R1 \leftarrow R3$$
- 2.10 Cycle Stealing by DMA controller has no effect on CPU operation.

3. Match words and phrases in column X with the closest related meaning/word(s)/phrase(s) in column Y. Enter your selection in the “tear-off” answer sheet attached to the question paper, following instructions therein. (1x10)

X		Y	
3.1	The basic logic circuit that performs manipulation of binary information	A.	ROM
3.2	A register that goes through a predetermined sequence of states upon the application of input pulses	B.	Pipelining
3.3	This is used to determine the type of instruction in the decode phase of the instruction cycle	C.	Trap
3.4	This helps in accessing consecutive elements of a data array	D.	VLSI
3.5	This is used to hold the most recently referenced page table entries	E.	D7
3.6	A technique of decomposing a sequential process into sub processes each one executing in a special dedicated segment	F.	Index Register
3.7	This type of interrupt arise from the illegal or erroneous use of an instruction or data	G.	TLB (Translation Look aside Buffer)
3.8	The library function may be stored in this type of memory	H.	Counter
3.9	Used for multiplication of binary integers	I.	Booth Algorithm
3.10	This contains thousands of gates within a single package	J.	Gate
		K.	Accumulator
		L.	Decoder
		M.	RAM
		N.	Banker's Algorithm

4. Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Enter your choice in the “tear-off” answer sheet attached to the question paper, following instructions therein. (1x10)

<b>A.</b>	CMA	<b>B.</b>	Control Memory	<b>C.</b>	RS Flip Flop
<b>D.</b>	Minterm	<b>E.</b>	Odd	<b>F.</b>	Zero Address
<b>G.</b>	Postfix	<b>H.</b>	Karnaugh’s map	<b>I.</b>	D Flip Flop
<b>J.</b>	Even	<b>K.</b>	One Address	<b>L.</b>	Strobe
<b>M.</b>	Condition Code	<b>N.</b>	Prefix		

- 4.1 A JK flip flop is a refinement of \_\_\_\_\_ flip flop.
- 4.2 Each combination of variables in a truth table is called a \_\_\_\_\_.
- 4.3 The parity method detects the presence of \_\_\_\_\_ number of errors.
- 4.4 In microprogrammed control, the control information is stored in a \_\_\_\_\_.
- 4.5 The pseudo instruction for complementing the accumulator is \_\_\_\_\_.
- 4.6 A stack organized computer has \_\_\_\_\_ instruction format.
- 4.7 One way of achieving the asynchronous data transfer is by means of a \_\_\_\_\_ pulse supplied by one of the units to indicate to the other unit when the transfer has to occur.
- 4.8 \_\_\_\_\_ are used to simplify Boolean expressions.
- 4.9  $AB^*CD^*+$  is \_\_\_\_\_ form of an arithmetic expression.
- 4.10 \_\_\_\_\_ bits are used to check the result of the last arithmetic operation performed in ALU (arithmetic and logic unit).

**PART TWO**  
(Answer **ALL** questions)

**5.**

- a) Represent the decimal number 46.5 as a floating point binary number with 24 bits. The normalized fraction mantissa has 16 bits and the exponent has 8 bits.
- b) How many address lines and input, output data lines are needed for a memory unit of 64K X 8 (where 64K is the number of words and word length is 8 bits).
- c) Simplify the following Boolean function using three variable K map?  
$$F(x,y,z) = \sum (2, 3, 5, 6, 7)$$

**(6+3+6)**

**6.**

- a) An 8-bit register contains the binary value 10011100. What is the register value after an arithmetic shift right? Starting from the initial number 10011100, determine the register value after an arithmetic shift left and state whether there is an overflow.
- b) What do you mean by asynchronous data transfer? Explain strobe controlled and hand shaking mechanism for asynchronous data transfer?
- c) What is the advantage of having different type of addressing modes? Explain Relative Addressing mode with the help of an example.

**(4+6+5)**

**7.**

- a) An instruction at address 021 in the basic computer has I=0, an operation code of the AND instruction and an address part equal to 083 (all numbers are in hexadecimal). The memory word at 083 contains the operand B8F2 and the content of AC is A937. Go over the instruction cycle and determine the contents of the following registers at the end of the execution phase: PC, AC, DR, AC and IR.
- b) Compare and Contrast the interrupt driven I/O and data transfer between memory and I/O device through the DMA controller.

**(6+9)**

**8.**

- a) What is virtual memory? Explain its implementation.
- b) Write an assembly language program to count the number of '\*' in a sequence of 20 characters stored at location X and put the result at location Y.
- c) Draw a flow chart depicting the divide operation of fixed point binary numbers.

**(5+5+5)**