SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION
(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Information Technology
2ⁿᵈ Year, Second Semester Examination – 2016
IT 2401/IT3002 - Computer Architecture

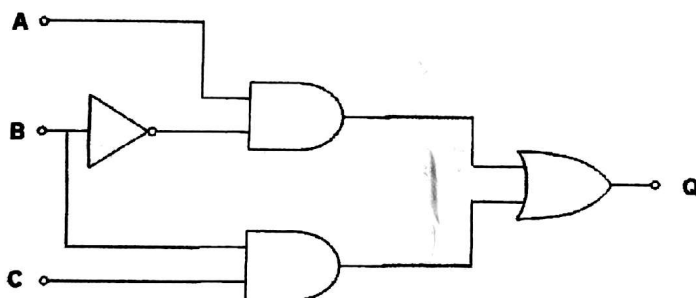Instructions for Candidates:
Answer any 4 questions

No. of questions : 05
No. of pages : 04
Duration : 2 hrs

Q1. **(Total 25 marks)**

(i). Consider the following logic circuit

    a). Draw the truth table for the circuit. **(04 Marks)**

    b). Give the Boolean expression for the above circuit. **(04 Marks)**

(ii). Simplify the following Boolean expressions using Boolean algebra. (Mention suitable laws in each steps) **(10 Marks)**

    a). $X = C.(A+C')$ **(02 marks)**

    b). $Y = A.C'+A.B.C'+ A'C'D' +A'C'D$ **(02 marks)**

    c). $Z = AB+ A'C + BC$ **(06 marks)**

(iii). Apply DeMorgan's theorem to simplify $\overline{A+\overline{(B+C)}}$ **(02 Marks)**

(iv). Simplify the following Boolean function F using K-Map

    $F = AB'C + AB'C' + A'B'C + A'B'C'$ **(05 Marks)**

Q2. (Total 25 marks)

(i). Briefly explain the following:

    a). PC (Program Counter)

    b). MAR (Memory Address Register)

    c). MBR (Memory Buffer Register)

    d). ALU (Arithmetic and Logical Unit)   (08 Marks)

(ii). Briefly explain Opcode and Operand in a machine instruction.   (04 Marks)

(iii). Explain instruction pipelining and mention stages of pipelining.

    (04 Marks)

(iv). "Instruction pipelining increases the through put of CPU. But some of the problems appear, which reduce the through put of CPU during pipelining." Identify and analyse three problems which decrease the performance of pipelining.

    (09 Marks)

Q3. (Total 25 marks)

(i). Compare and contrast the Static Random Access Memory (SRAM) and Dynamic Random Access Memory (DRAM).   (04 Marks)

(ii). Briefly explain "Seek Time", "Rotational Latency" and "Transfer Time" of a hard disk drive operation.   (06 Marks)

(iii). Consider the following details of a Hard Disk:

    Average seek time = 6 ms.

    Disk rotation speed = 7600 rpm

    512 bytes/sector

    400 sectors/track (on average)

    20,000 tracks/surface

    Disk has 5 platters

a). Calculate the average rotational latency

b). Calculate the capacity of this hard disk

c). Calculate the total time needed to read 300KB data file (assume the file is not fragmented)

(06 Marks)

(iv). Explain function of Cache Memory.

(02 Marks)

(v). Using memory hierarchy diagram, explain each type of memory in the hierarchy and their characteristics change by level.

(07 Marks)

Q4.   (Total 25 marks)

(i). Write down the three types of buses in the CPU system and explain them. briefly.

. (09 Marks)

(ii). State down any four (04) major functions of an Input/output Module.

(04 Marks)

(iii). Briefly explain the following techniques in I/O Module.

a). Programmed (polling) I/O

b). Interrupt driven I/O.

c). Direct Memory Access (DMA)   (03x2=06 Marks)

(iv). "External devices are not generally connected directly into the computer bus structure." Briefly explain this statement.   (03 Marks)

(v). Give the advantage of single bus "Single-bus, integrated DMA-I/O" over "Single-bus, detached DMA"

(03 Marks)

Q5. **(Total 25 marks)**

(i). Briefly explain why process scheduling is important? (02 Marks)

(ii). Let CPI= average cycles per instruction, I=number of instruction in a programme and T= clock cycle time,

        a). Define CPU Execution Time in term of I, T and CPI (03 Marks)

           According to the data given below;

           Clock rate = 4 GHz

           Average Cycles per instruction = 3

           Number of instructions in a programme = 400

        b). Calculate clock cycle time? (04 Marks)

        c). Calculate CPU execution time of this programme. (04 Marks)

(iii). What is pre-emptive and non-pre-emptive scheduling means? (04 Marks)

(iv). Using **pre-emptive shortest job first algorithm**, indicate the order of execution of each process in a time line and calculate the average waiting time for the processes given below. (06 Marks)

Process	Arrival Time (in sec)	Service Time (in sec)
P1	8	3
P2	2	1
P3	1	3
P4	3	2
P5	4	4

(v). What is meant by deadlock (02 Marks)