JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE DEGREE OF BSC IN COMPUTER SECURITY AND FORENSIC

1ST YEAR 2ND SEMESTER 2016/ 2017 ACADEMIC YEAR

COURSE CODE: IIT 3123

COURSE TITLE: COMPUTER SYSTEMS ARCHITECTURES

EXAM VENUE: MAIN CAMPUS

DATE: STREAM: BSC FORENSICS

TIME: 2 HOURS EXAM SESSION:

INSTRUCTIONS:

1. **Answer question 1 in Section A (Compulsory) and any other two questions in Section B**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE (30 MARKS)

a) Computer system is comprised of three main subsystems. Name each subsystem and its function in the computer. (3 marks)

b) Explain the difference between volatile and non-volatile memory. Give an example for each case. (4 marks)

c) With the help of a suitable diagram, describe the three main computer buses and their functions. (6 marks)

d) Convert the following binary number (110011) into decimal number. (2 marks)

e) Several logic gates exist in digital logic circuits. These logic gates can be used to implement logical operation. Draw circuit symbols and truth table for the following logic gate: (6 marks)

   i. EX-OR gate
   ii. NAND gate
   iii. NOR gate

f) Differentiate between cache memory and computer registers (2 marks)

g) Explain the meaning of interrupt and how it can help improve the performance of a computer (3 marks)

h) With the aid of a suitable diagram, discuss the concept of Von Neumann computer architecture (4 marks)

QUESTION TWO (20 MARKS)

a) Computer I/O devices provide interfaces for user interaction with computers.

   i. Name and explain the functions of any four input devices. (4 marks)
   ii. Name and explain the functions of any four output devices. (4 marks)

b) A full adder is a combinational circuit that forms the arithmetic sum of three bits.

   i. Draw a circuit diagram of a full adder and describe how it works. (6 marks)
   ii. You have been given two 4-bit binary numbers A= 1001 and B= 0011. Demonstrate how you would add them using a full adder. (6 marks)

QUESTION THREE (20 MARKS)

a) Computer system memory is organized in a hierarchical structure, with the main aim of getting a perfect tradeoff between cost and performance. With the aid of a suitable diagram, discuss the computer memory hierarchy. (10 marks)

b) A multiplexer gate is a three-input gate that uses one of the inputs, called selection bits to select and output one of the other two inputs, called data bits.

i. Draw a circuit diagram of a typical multiplexor and explain how it works. (6 marks)
ii. Prepare a truth table for the multiplexor in b (i) above. (4 marks)

QUESTION FOUR (20 MARKS)

a) An electronic flip-flop is a circuit that has two stable states and can be used to store state information.

i. Explain two common types of electronic flip flops (4 marks)
ii. Draw a circuit diagram for a flip flop and explain how it works (6 marks)

b) Computer systems are designed with many registers that perform different functions.

c) State and explain the functions of five different types of computer registers. (10 marks)

QUESTION FIVE (20 MARKS)

a) The basic function performed by a computer is execution of a program, which consists of a set of instructions stored in memory.

i. With the help of an appropriate diagram, discuss the fetch execute cycle (5 marks)
ii. For any given instruction cycle in the computer, some states may be null and others may be visited more than once. State and explain the seven possible states. (7 marks)

b) As computer systems evolve, greater performance can be achieved by taking advantage of improvements in technology, such as faster circuitry, use of multiple registers rather than a single accumulator, and the use of a cache memory. Another computer organizational approach is instruction pipelining in which new inputs are accepted at one end before previously accepted inputs appear as outputs at the other end. Using the following six stages, demonstrate how pipelining would lead to computational speedup. (8 marks)

1. Fetch instruction (FI
2. Decode instruction (DI)
3. Calculate operands (CO)
4. Fetch operands (FO)
5. Execute instruction (EI)
6. Write operand (WO)