THE KENYA POLYTECHNIC

ELECTRICAL/ELECTRONICS ENGINEERING

DEPARTMENT

HIGHER DIPLOMA IN ELECTRICAL ENGINEERING

END OF YEAR II EXAMINATIONS

NOVEMBER 2006

MICROELECTRONICS II

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Calculator/Mathematical tables

Answer any FIVE of the following EIGHT questions.

All questions carry equal marks and the maximum marks for each part of a question are as shown.

This paper consists of 6 printed pages.

1. (a) (i) Draw a well labeled diagram showing the internal architecture of 8086 microprocessor.

   (ii) Briefly describe the role of the execution unit (EU) and the bus interface unit (BIU) in 8086 microprocessor. (10 marks)

   (b) With the aid of a flow chart, write an 8086 assembly language program that calculates the sum of all the integers between one and a hundred (1-100) and store the result in the accumulator. (5 marks)

   (c) (i) Differentiate between minimum and maximum mode operation of 8086 processor.

   (ii) Write an 8086 program required to output the word in BX to I/O ports 8004H and 8005H. (5 marks)

2. (a) Define the term pipelining as used in 8086 microprocessor and state its role. (2 marks)

   (b) (i) Below are the contents of the segment registers:

   DS = 2000H

   CS = 348AH

   SS = 5000H

   ES = 7000H

   Determine the bottom and top physical addresses for the four memory segments above. (8 marks)

   (ii) Using the information provided in (i) above,

   I. If SI=00ABH determine the memory location that will be accessed as the string source.

   II. If IP=2600H, determine where the next fetch will come from.

   III. If DI=FFFFH determine the memory location that will be accessed as the string destination. (6 marks)

   (c) Distinguish between physical address and logical address giving examples in each. (4 marks)

3. (a) Differentiate between maskable and non-maskable interrupts giving examples from Z80 microprocessor. (3 marks)

(b) Using a clear diagram explain the daisy chain interrupt priority approach. (7 marks)

(c) List the three modes of $\overline{INT}$ interrupt request for Z80 microprocessor and briefly describe how interrupt vector is generated in each case. (6 marks)

(d) Write an 8086 program to input two 8-bit unsigned numbers from input ports AΦH and BΦH and output the product of the two numbers to 16-bit output port 7080H. (4 marks)

4. (a) (i) Define the following terms as used in microprocessors:

I. T-state II. Machine cycle

III. Instruction cycle

(ii) Draw a well labeled diagram showing how odd and even 8255A PPI are interfaced to 8086 microprocessor. (10 marks)

(b) Using a clearly labeled diagram, show the changes that take place in buses and control signal lines during a memory read cycle. (6 marks)

(c) Determine the contents of register AL and the state of the flags after the following instructions of the 8086 microprocessor are executed:

MOV	AL, 6DH;	Load AL with 6DH
MOV	BH, 4OH;	Load BH with 4OH
AND	AL, BH;	AND AL with BH

(4 marks)

5. (a) (i) State the difference between Z80 CTC counter and timer mode.

(ii) Briefly describe the three control words possible in Z80 CTC.

(iii) Sketch a well labeled flow diagram of events followed when CTC is programmed in the counter mode. (14 marks)

(b) (i) State the addressing modes for each of the following 8086 microprocessor instructions:

I. JMP [BX+DI] II. MOV SB

III. MOV AX, [SI]

(ii) Differentiate between a microcontroller and a microprocessor.

(iii) State what is meant by bus contention. (6 marks)

6. (a) Define the term microcomputer development system (MDS).

(b) Using a labeled flow chart, show the typical sequence followed in software development.

(c) A microcomputer system memory is made up of two $1K \times 8$ ROM, one $1K \times 8$ RAM and two $½K \times 8$ EPROMS.

(i) Determine the total capacity in kilobytes.

(ii) Deduce the number of chips

(iii) Derive the memory map assuming the first chip's memory originates from location 0000H.

(iv) Draw the memory organization. (7 marks)

7. (a) (i) State any THREE possible faults that can be found in a microprocessor based system.

(ii) State THREE types of test equipment for faults in microprocessor based systems.

(iii) Draw a well labeled diagram of a logic analyzer and state its advantages. (13 marks)

(b) (i) Describe how a RAM memory can be tested.

(ii) Define the term virtual memory

(iii) 8086 makes use of Bus Interface Unit and execution unit to be faster. State THREE independent units in 80386 microprocessor. (7 marks)

8. (a) Figure 8(a) illustrates one step in an industrial process that is to be computerized. A chemical solution is to be heated before being passed on to the next station. Below are specifications from the engineer:

1. Fill the tank to its capacity

(a) Open the inlet valve: $\overline{INFLOW} = 0$

(b) Close the outflow valve: $\overline{OUTFLOW} = 1$

(c) Turn off the heater: HTRON = 0

(d) Wait until tank is full: TANKFUL = 1

2. Heat solution in the tank until its temperature is 90^0C.

(a) Close the inlet valve: $\overline{INFLOW} = 1$

(b) Turn on the heater: HTRON = 1

(c) Wait for solution to heat: $\overline{TEMPOK} = 0$

3. Empty the tank.

(a) Turn off the heater: HTRON = 0

(b) Open the outlet valve: $\overline{OUTFLOW} = 0$

(c) Wait for tank to empty: $\overline{TANKMT} = 0$

4. Go to step 1.

The process also has an emergency shut down switch. When pushed the entire is shut down and when emergency condition is removed the process is restarted.

Figure 8(b) shows computer interface and bit assignment.

With the aid of a flow chart, write an 8086 assembly language program that will facilitate the process control as per the given specifications. (Take don't care bits to be zeroes). (16 marks)

(b) Explain the operation of the following program:

```
MOV  BL, 47H
IN   AL, 36H
CMP  AL, BL
JE   MATCH
JA   BIG
JMP  SMALL
```

(4 marks)

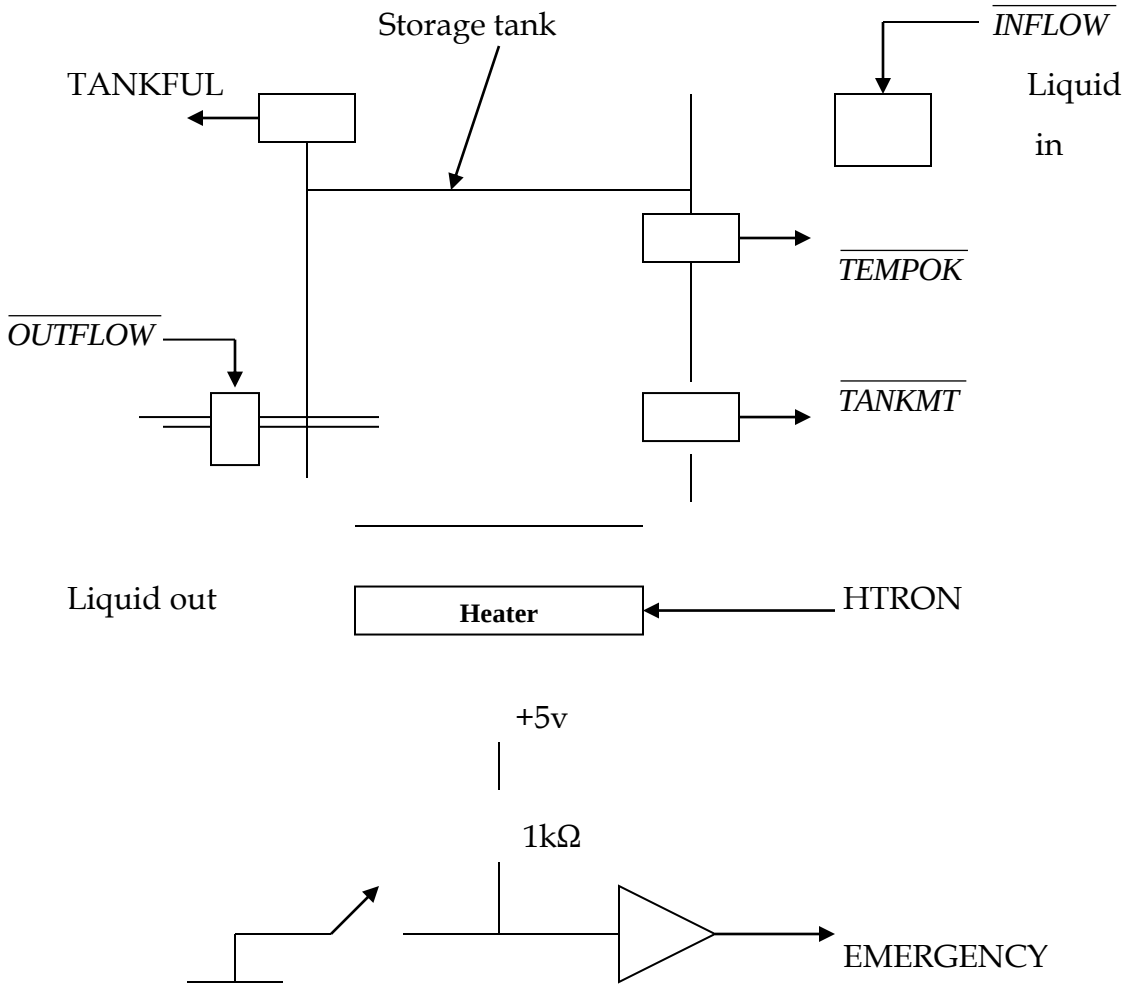

Figure 8(a)

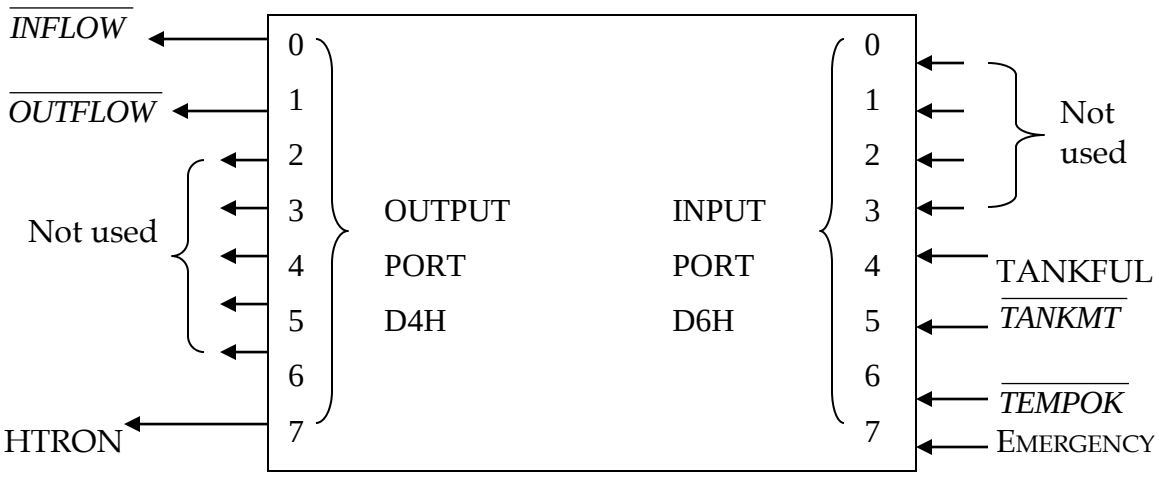

Figure 8(b)