FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 4

EEE417- DIGITAL ELECTRONICS 1B

FINAL EXAMINATION – PENSTER 4, 2016

TIME ALLOWED: 2 HOURS + 10 MINUTES READING.

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.

2. Begin each answer on a fresh page and use both sides of the sheet.

3. Write your candidate-number at the top of each attached sheet

4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string

5. For all sheets of paper on which rough/draft work has been done, cross it through and you MUST ATTACH to your answer scripts.

6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.

7. ANSWER ALL QUESTIONS.

8. Show all workings where necessary.

9. Do not use programmable calculators, especially the ones that does the conversions of number systems.

*10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

Section A **Multiple Choice** **[20 Marks]**

Choose the best answer and write the correct alphabet beside the question number in your answer booklet.

1) The Stored cell in a SRAM is

   A) A flip flop
   B) A capacitor
   C) A fuse
   D) A magnetic domain

2) A flash memory is

   A) Volatile
   B) A read/write memory
   C) Non volatile
   D) Answers B and C

3) Proper handling of CMOS device is necessary because of it's

   A) Fragile construction
   B) High noise immunity
   C) Susceptibility to electrostatic discharge
   D) Lower power dissipation

4) The main advantage of ECL over TTL and CMOS

   A) ECL is less expensive
   B) ECL consumes less power
   C) ECL is available in a greater variety of circuit types
   D) ECL is faster

5) Which of the following is not a TTL circuit?

   A) 7400
   B) 74S00
   C) 74HC00
   D) 74AS00

6) If a 7485 magnitude comparator has A =1010 and B = 1011 on its inputs, the outputs are

   A) A<B = 0, A>B = 1, A = B = 0

B) A<B = 1, A>B = 1, A = B = 0
C) A<B = 1, A>B = 0, A = B = 0
D) A<B = 0, A>B = 0, A = B = 0

7) If a 4-line to 16 decoder with active LOW outputs exhibits a LOW on a decimal 10 output, what are the outputs?
   A) $A_3A_2A_1A_0 = 1010$
   B) $A_3A_2A_1A_0 = 1110$
   C) $A_3A_2A_1A_0 = 1100$
   D) $A_3A_2A_1A_0 = 0100$

8) A BCD – to 7 – segment decoder has 0010 on its inputs. The active outputs on the seven segment display are
   A) a,b,c,f,g
   B) a,b,d,e,g
   C) a,c,d,e,f
   D) a,b,d,f,g

9) if an octal to binary priority encoder has its 0, 3, 5 and 7 inputs at the active level, the active HIGH binary output is
   A) 111
   B) 010
   C) 101
   D) 110

10) In general, a multiplexer has
   A) One data input, several data outputs and selection inputs
   B) One data input, one data output and one selection input
   C) Several data inputs, several data outputs and selection inputs
   D) Several data input, one data output and selection inputs

11) Data selectors are basically the same as
   A) Decoders
   B) Demultiplexers
   C) Multiplexers
   D) Encoders

12) Data are stored in a random access memory (RAM) during the
   A) Read operation
   B) Enable operation
   C) Write operation
   D) Addressing operation

13) In a binary weighted digital-to-analog converter (DAC), the resistors on the inputs
   A) Determine the amplitude of the analog signal
   B) Determine the weights of the digital inputs
   C) Limit the power consumption
   D) Prevent loading on the source

14) In an R/2R DAC there are
   A) Four values of resistors
   B) One resistor values
   C) Two resistor values
   D) A number of resistor values equal to the number of inputs

15) An input of +3.9V to a TTL IC (+5V supply) would be considered a _____ logic level.
   A) high
   B) low
   C) undefined
   D) none of the above

16) The general name for an electronic device that translates from Decimal to Binary is a (n) _____.
   A) encoder
   B) decoder
   C) comparator
   D) multiplexer

17) The design of circuitry that translates voltages and currents between devices (such as TTL and CMOS) is called _____.
   A) interlacing
   B) sinking
   C) boundary scanning
   D) Interfacing

18) The nematic fluid sandwiched between the glass plates of a LCD is also called _____ _____.

   A) green phosphor
   B) metalized segments
   C) liquid crystal
   D) plasma

19) Two types of RAM semiconductor memories are the DRAM and _____.
   A) SRAM

B) TRAM
C) BRAM
D) None of the above

20) A binary-weighted resistor used in a digital-to-analog converter (DAC) is only practical up to a resolution of _____.
A) 10 bits
B) 2 bits
C) 8 bits
D) 4 bits

SECTION B **TOPIC 1** **[20 Marks]**

1. Which type of transistor do you find in a TTL IC and CMOS IC? (2 marks)

2. What are the three performance characteristics to identify any TTL IC.(3 marks)

3. Refer to the table below and make your analysis on the three types of gates in terms of their speed, power consumption, noise margin, fan-in and fan-out. While comparing, state which one is best to use. (5 marks)

Type of Gate	Fan-in	Fan-out	Propagation delay (ns)	Noise margin (V)	Power consumption (mW)
TTL	7	11	8	0.5	50
CMOS	10	55	28	1.8	3
ECL	6	55	1.2	0.5	28

4. Using the attached datasheet, determine:
a) What DM74LS32 mean? (2 marks)
b) Nominal V_{CC}. (1 mark)
c) Power dissipation, P_D (3 marks)
d) High-level noise margin, V_{NH} (2 marks)
e) Low-level noise margin, V_{NL} (2 marks)

Absolute Maximum Ratings

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature	0oC to +70oC
Storage Temperature Range	-65oC to +150oC

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
Vcc	Supply Voltage	4.75	5	5.25	V
Vih	HIGH Level Input Voltage	2			V
Vil	LOW Level Input Voltage			0.8	V
Ioh	HIGH Level Output Current			-0.4	mA
Iol	LOW Level Output Current			16	mA
Ta	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

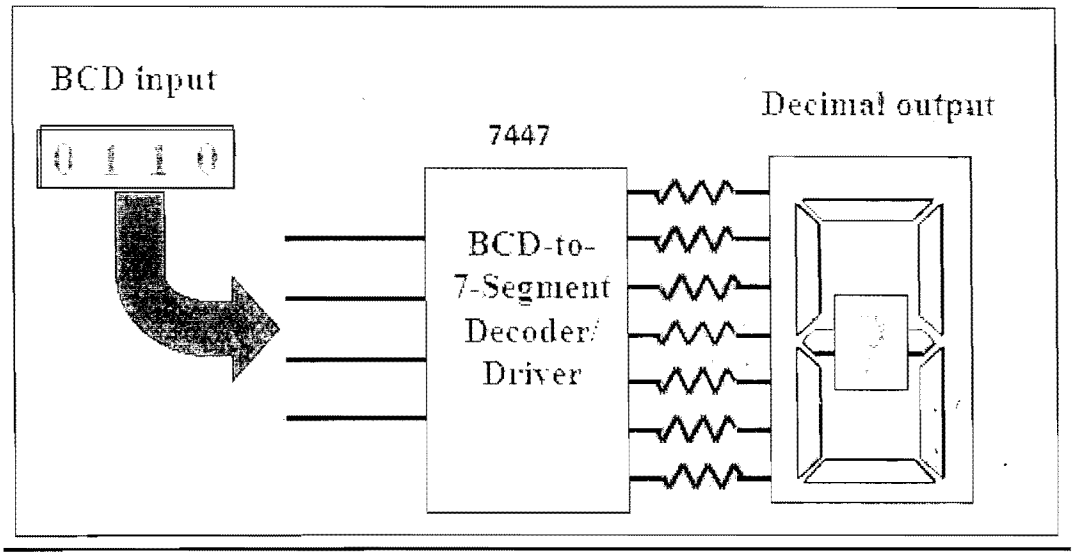
Symbol	Parameter	Conditions	Min	Typ	Max	Units
Vi	Input Clamp Voltage	Vcc=Min,Ii=-12mA			-1.5	V
Voh	HIGH Level Output Voltage	Vcc=Min,Ioh=MAX,Vil=MAX	2.4	3.4		V
Vol	LOW Level Output Voltage	Vcc=Min,Iol=MAX,Vih=MAX		0.2	0.4	V
Ii	Input Current@MAX Input Voltage	Vcc=Max,Vi=5.5V			1	mA
Iih	HIGH Level Input Current	Vcc=Max,Vi=2.4V			40	µA
Iil	LOW Level Input Current	Vcc=Max,Vi=0.4V			-1.6	mA
Ios			-18		--	
Icch	Supply Current with Outputs HIGH	Vcc=Max		4	8	mA
Iccl	Supply Current with Outputs LOW	Vcc=Max		12	22	mA

Switching Characteristics at Vcc=5V,Ta=25oC

Symbol	Parameter	Conditions	Min	Typ	Max	Units
tplh						
tphl	Propagation Delay Time HIGH-to-LOW Level Output	Cl=15pF Rl=400R			15	nS

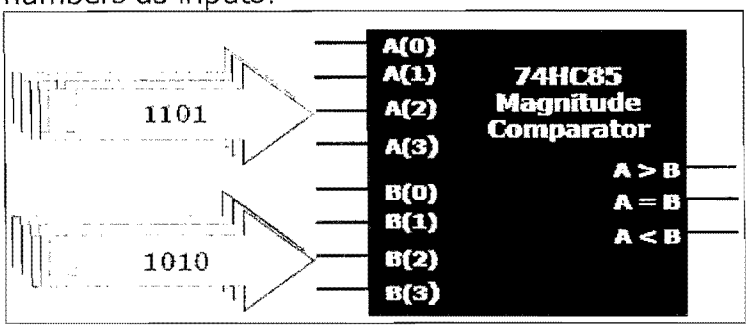
SECTION C **TOPIC 2** **[20 marks]**

1. Refer to the diagram below and answer the following questions:
   a. Determine what decimal digit will appear from the Decimal output.(2 marks)
   b. Name the display. (1 mark)
   c. If the BCD input is 1001, what segments will be illuminated? (2 marks)
   d. Give a reason why the 74LS47 has only 7 outputs. (1 mark)



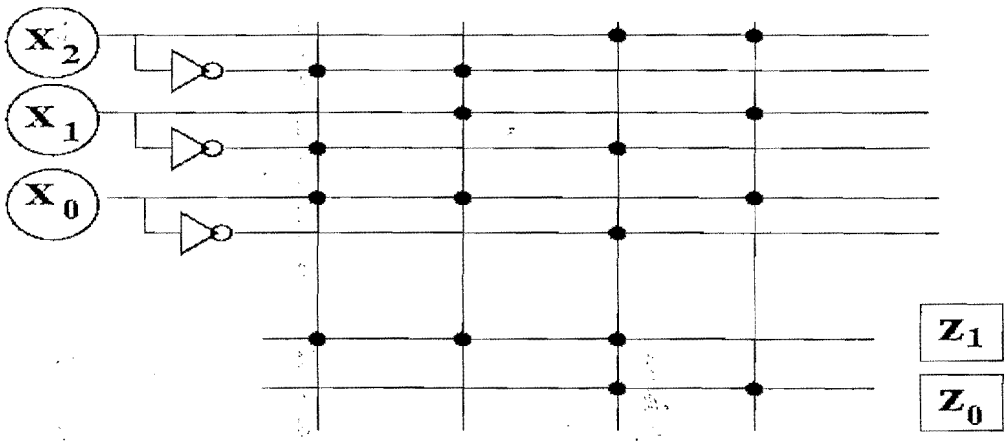
2. What is the function of a De - multiplexer (DEMUX) and also draw the logic symbol for 1-of- 4 De - multiplexer. (4 marks)

3. Which output of the comparator IC will be activated with these two 4-bit binary numbers as inputs? (2 marks)



4. What is the purpose of the following:
   i) Decoder (1 mark)
   ii) Encoder (1 mark)
   iii) Multiplexer (1 mark)

5. Determine the truth table for the given programmable logic array (PLA). (5 marks)



SECTION D **TOPIC 3** **[15 marks]**

1. Figure – 1d below shows a four - bit Digital to Analog converter (DAC).

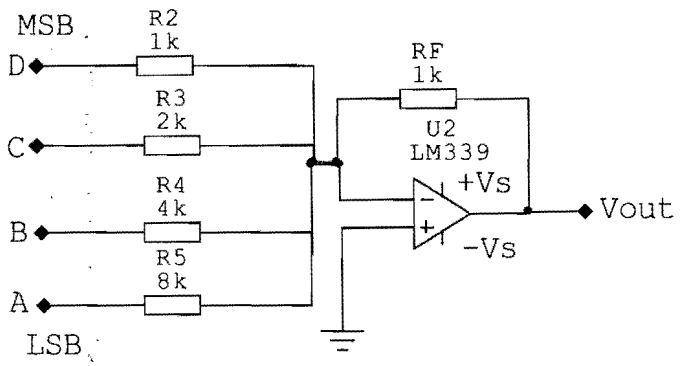


Figure – 1d

Calculate the output voltage **(Vout)** if the DCBA inputs are as follows respectively:

i. 1011
ii. 1100

Note: Logic 1 voltage = 5 volts. (4 marks)

2. Determine the resolution expressed as percentage of the following:

   (a) An 8 bit DAC (1.5 marks)

   (b) A 12 bit DAC (1.5 marks)

3. a. Determine what circuit is given in Figure 3b. (1 mark)
   b. Explain the advantage of using this type of circuit compared to others. (1 mark)
   c. Determine the binary code output of the 3 – bit flash ADC for the analog input signal in Figure below and the sampling pulses (encoder enable) shown. V_{REF} = +8V

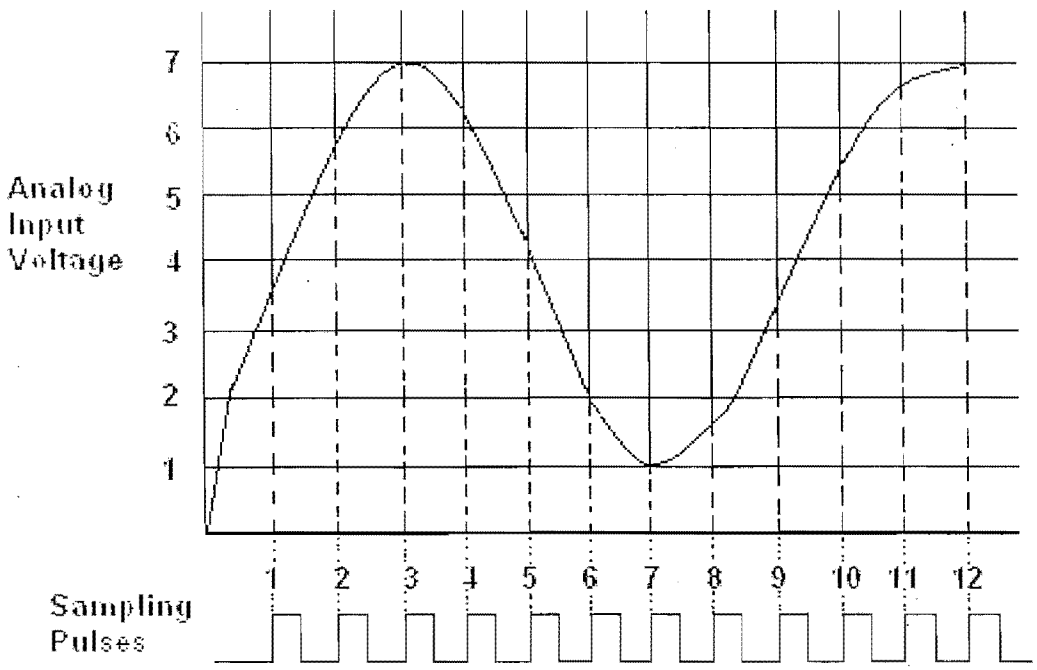
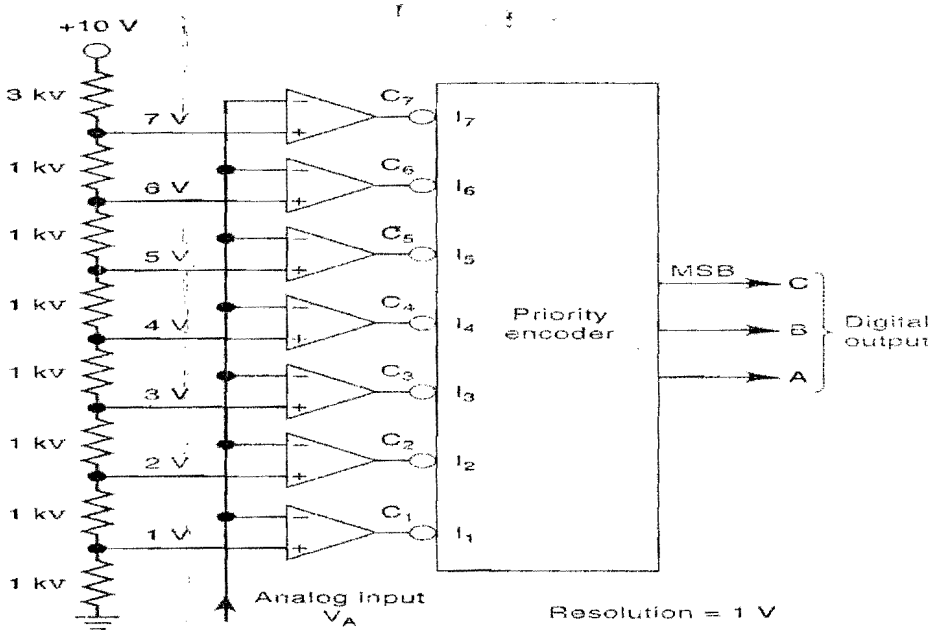


Figure – 3a



Analog in	Comparator outputs							Digital outputs		
V_A	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C	B	A
0–1 V	1	1	1	1	1	1	1	0	0	
1–2 V	0	1	1	1	1	1	1	0	0	
2–3 V	0	0	1	1	1	1	1	0	1	
3–4 V	0	0	0	1	1	1	1	0	1	
4–5 V	0	0	0	0	1	1	1	1	0	
5–6 V	0	0	0	0	0	1	1	1	0	
6–7 V	0	0	0	0	0	0	1	1	1	
> 7 V	0	0	0	0	0	0	0	1	1	

Figure – 3b (6 marks)

SECTION E **TOPIC 4** **[15 marks]**

1. Figure – 3a below shows an indicator circuit. Calculate the resistance value R_1 needed for the circuit.

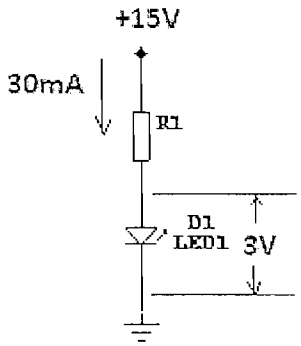
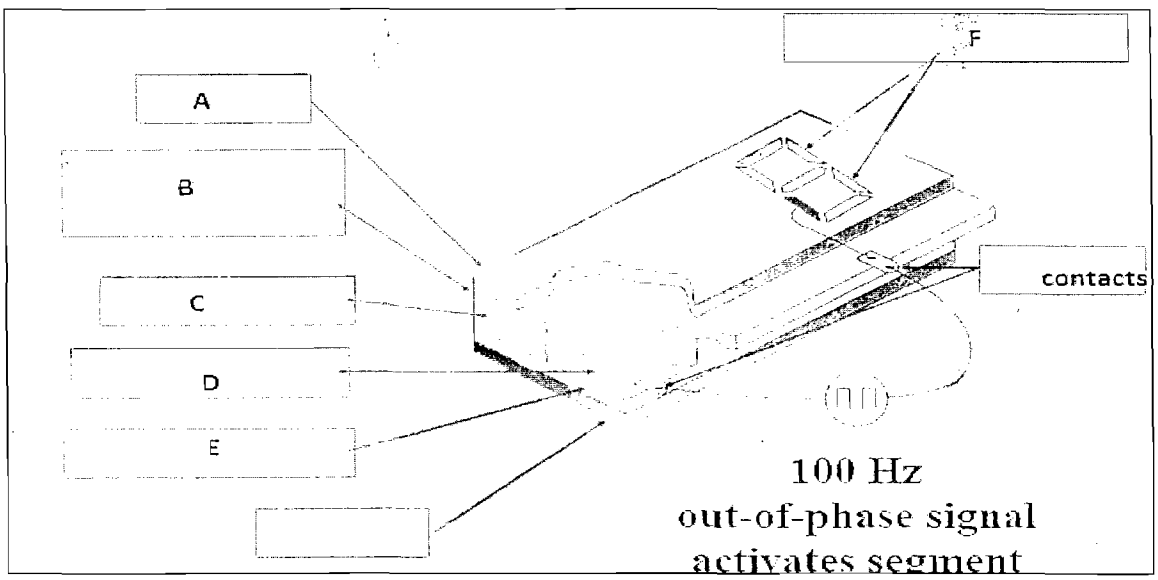
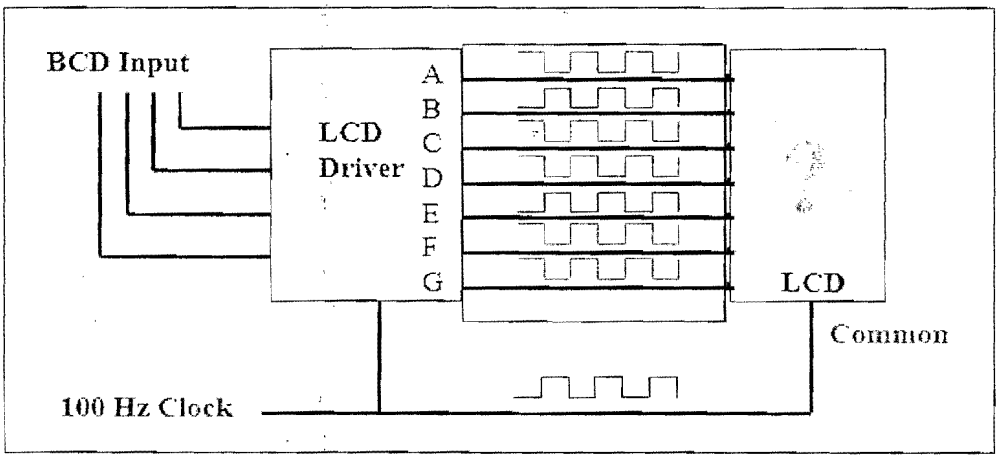


Fig – 3a (3 marks)

2. i) Name the display device (1 mark)
   ii) Label the parts from A - F. (6 marks)
   iii) Briefly explain the operation of the device (3 marks)



3.What will be the output on the LCD display? (2 marks)



SECTION F **TOPIC 5** **[10 marks]**

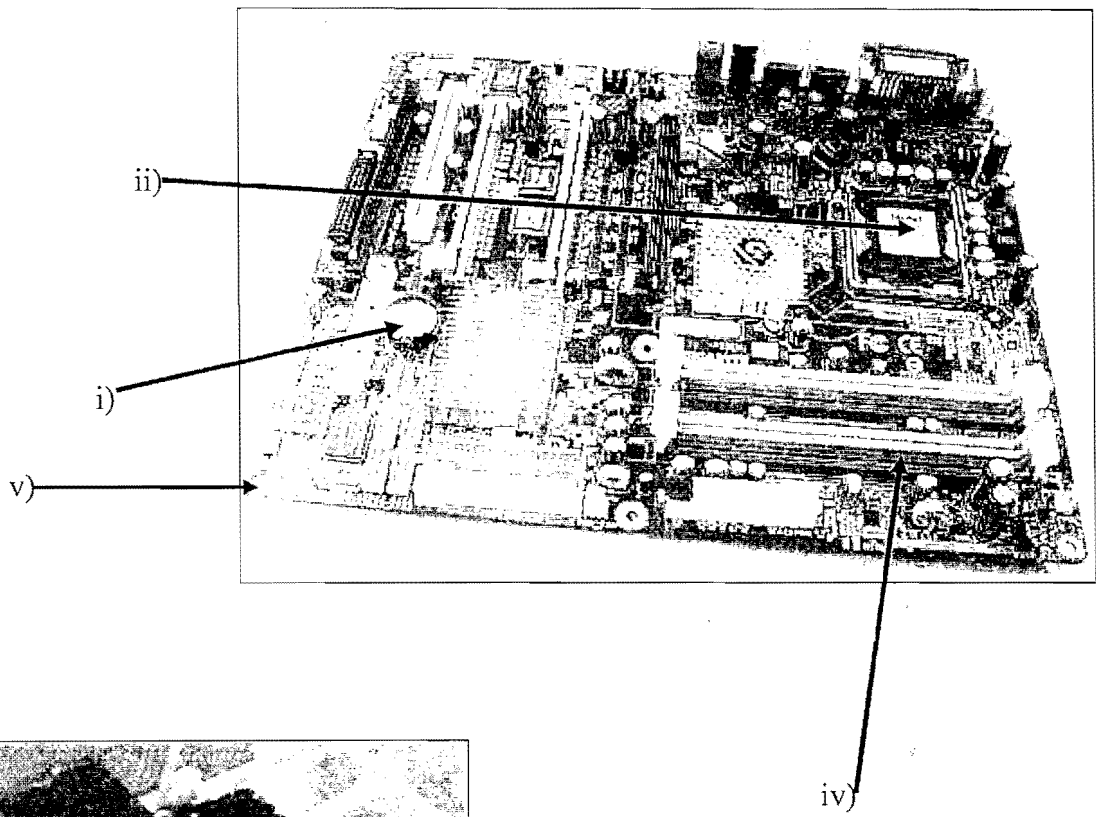
For question number 1 below, choose the best answer form the list by writing the answer against the question number in the answer booklet provided.

Logic Probe, Hard disk, EPROM, Manufacturer, Firmware, Flash RAM, ROM, Magnetic Disks, SIMM, CMOS RAMs, EEPROM, DIMM, Specification, DVD-ROM, Magnetic tape

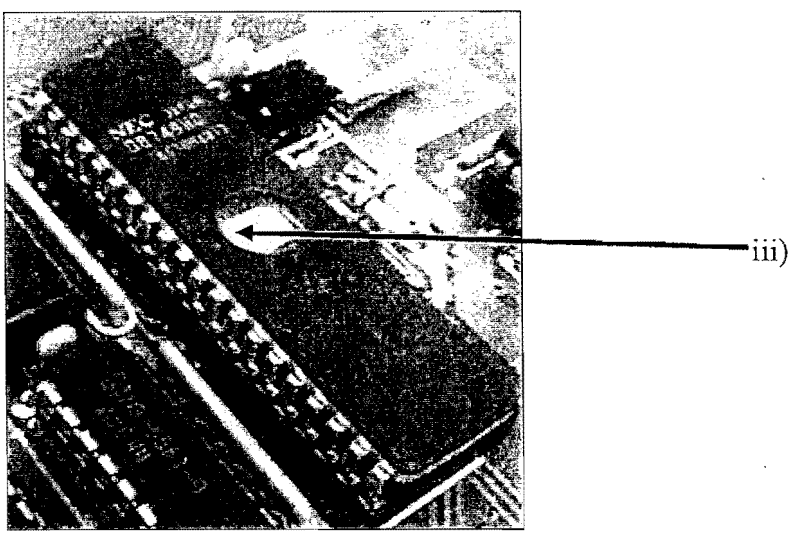
(5 marks)

1. a) A type of optical disk.
   b) Most important bulk storage memory device used in modern computer system.
   c) Non- volatile but electrically erasable by bytes for reprogramming, lower density with high cost.
   d) Usually programmed read-only memory to user specification.
   e) Dual-in-line memory module.
   f) Use with battery backup because they consume less power.

2. Identify the following labels:



3.



(5 marks)

**********THE END**********