

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 2, 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) If a 7485 magnitude comparator has $A = 1011$ and $B = 1001$ on its inputs, the outputs are
 - A) $A > B = 0, A < B = 1, A = B = 0$
 - B) $A > B = 1, A < B = 0, A = B = 0$
 - C) $A > B = 1, A < B = 1, A = B = 0$
 - D) $A > B = 0, A < B = 0, A = B = 0$

- 2) If a 4-line to 16 decoder with active LOW outputs exhibits a LOW on a decimal 12 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) $A_3A_2A_1A_0 = 0100$

- 3) A BCD – to 7 – segment decoder has 0100 on its inputs. The active outputs are
 - A) a,c,f,g
 - B) b,c,f,g
 - C) b,c,e,f
 - D) b,d,e,g

- 4) if an octal to binary priority encoder has its 0, 2, 5 and 6 inputs at the active level, the active HIGH binary output is
 - A) 110
 - B) 010
 - C) 101
 - D) 000

- 5) 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

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

-
- 7) A 64 bit data word consists of
- A) 2 bytes
 - B) 4 nibbles
 - C) 8 bytes
 - D) 3 bytes and 1 nibble
- 8) Data are stored in a random access memory (RAM) during the
- A) Read operation
 - B) Enable operation
 - C) Write operation
 - D) Addressing operation
- 9) 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
- 10) 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
- 11) 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
- 12) The general name for an electronic device that translates from binary to decimal is a (n) _____.
- A) encoder
 - B) decoder
 - C) comparator
 - D) multiplexer
- 13) 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
- 14) A ROM is:
- A) Volatile memory
 - B) Non-volatile memory
 - C) Read/write memory
 - D) Electrically erasable memory
- 15) The functional capacity for MSI devices is _____.
- A) 12 to 99 gates.
 - B) Over 100,000 gates.
 - C) 100 to 10,000 gates.
 - D) more than 10,000 gates.
- 16) 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
- 17) Two types of RAM semiconductor memories are the DRAM and _____.
- A) SRAM
 - B) TRAM
 - C) BRAM
 - D) None of the above
- 18) 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
- 19) Which of the following is a CMOS circuit?
- A) 74AL00
 - B) 74HC00
 - C) 74F00
 - D) 74AS00
- 20) A(n) _____ converts an analog input to a digital output.
- A) DAC
 - B) ADC

- C) bipolar converter
- D) flash converter

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	10	15	10	0.6	45
CMOS	10	60	32	1.7	1
ECL	7	60	1.5	0.6	35

4. Using the attached datasheet, determine:
 - a) What DM74LS02 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)

DM74LS00 Quad 2-Input NAND Gate

General Description

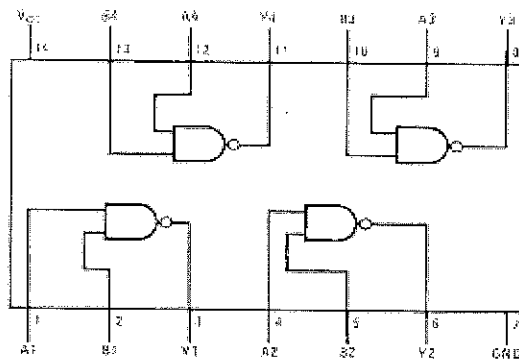
This device contains four independent gates each of which performs the logic NAND function.

Ordering Code:

Order Number	Package Number	Package Description
DM74LS00M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
DM74LS00SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS00N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

$$Y = \overline{AB}$$

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

H = HIGH Logic Level
L = LOW Logic Level

Absolute Maximum Ratings (Note 1)

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

Note 1: The 'Absolute Maximum Ratings' are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The 'Recommended Operating Conditions' table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = -18 mA			-1.8	V
V _{O1H}	HIGH Level Output Voltage	V _{CC} = Min, I _{O1H} = Max, V _{IL} = Max	2.7	3.4		V
V _{O1L}	LOW Level Output Voltage	V _{CC} = Min, I _{O1L} = Max, V _{IH} = Min		0.35	0.5	V
		I _{OL} = 4 mA, V _{CC} = Min		0.25	0.4	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 7V			0.1	mA
I _{I1}	HIGH Level Input Current	V _{CC} = Max, V _I = 2.7V			20	µA
I _{I2}	LOW Level Input Current	V _{CC} = Max, V _I = 0.4V			-0.36	mA
I _{SH}	Short Circuit Output Current	V _{CC} = Max (Note 3)	-20		100	mA
I _{CC1}	Supply Current with Outputs HIGH	V _{CC} = Max		0.8	1.5	mA
I _{CC2}	Supply Current with Outputs LOW	V _{CC} = Max		2.4	4.4	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

at V_{CC} = 5V and T_A = 25°C

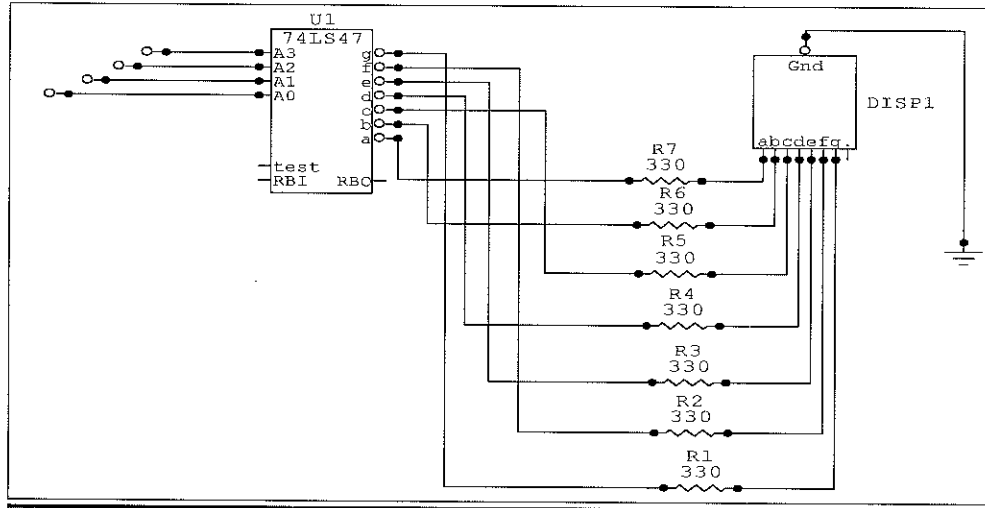
Symbol	Parameter	R _L = 2 kΩ				Units
		C _L = 15 pF		C _L = 50 pF		
		Min	Max	Min	Max	
t _{PHL}	Propagation Delay Time LOW-to-HIGH Level Output	3	10	4	15	ns
t _{PLH}	Propagation Delay Time HIGH-to-LOW Level Output	3	10	4	15	ns

SECTION C

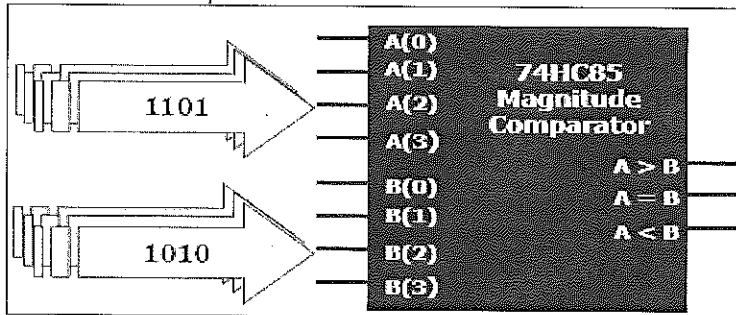
TOPIC 2

[20 marks]

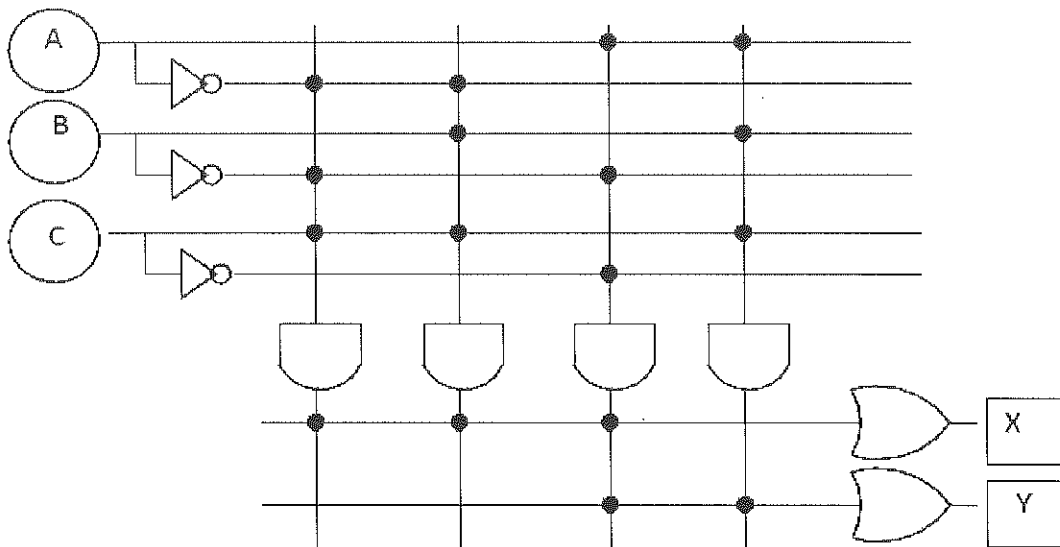
1. Refer to the diagram below and answer the following questions:
 - a. Determine what decimal digit will appear from the given digital circuit if $A_3=1$, $A_2=0$, $A_1=0$, $A_0=1$. (2 marks)
 - b. Name the display. (1 mark)
 - c. What is the purpose of the test input of the 74LS47 IC? (2 marks)
 - d. Give a reason why the 74LS47 has only 7 outputs. (1 mark)



2. What is the function of a multiplexer (MUX) and also draw the logic symbol for 1-of-4 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) Demultiplexer (1 mark)
5. Determine the Boolean equation for the given programmable logic array. (5 marks)

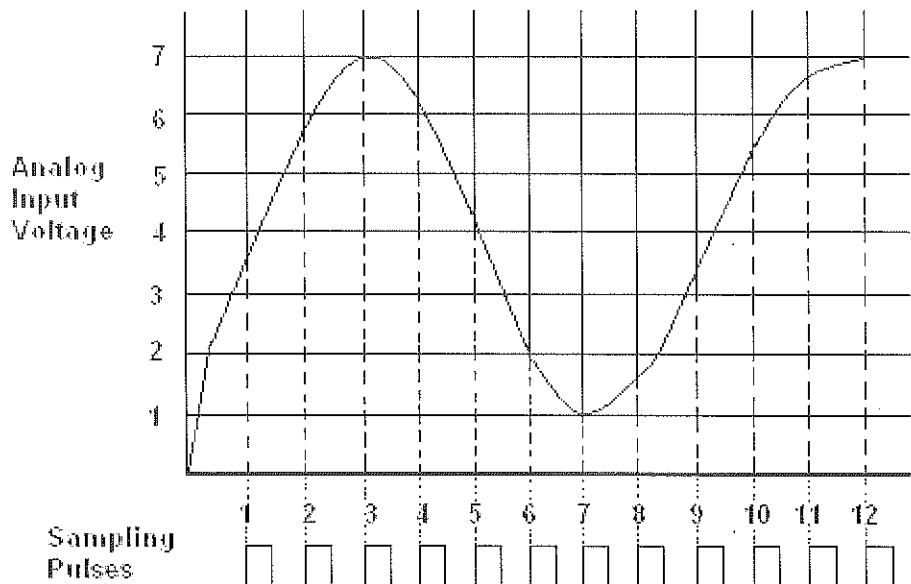


SECTION D

TOPIC 3

[15 marks]

1. Determine the binary coded output of the 3 – bit flash ADC for the analog input signal in Figure below and the sampling pulses (encoder enable) shown. $V_{REF} = +8V$



(6 marks)

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2. (a) Name the circuit that converts data from the computer to the telephone line. (1 mark)
- (b) Which circuit is used to convert data from a telephone line to a computer? (1 mark)
- (c) Name the circuit that has a quantizing circuit for its conversion. (1 mark)
- (d) What equipment has both the converters to convert data to and from the computer to the telephone line? (1 mark)
3. A weighted-resistor DAC has $R_F = 20K\Omega$ and $R = 12.5K\Omega$. Calculate its output voltage when the 4-bit digital input word is:
- a) 1010 (2.5 marks)
- b) 0101. (2.5 marks)

Note: Logic 1 voltage = 5 volts.

SECTION E

TOPIC 4

[15 marks]

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

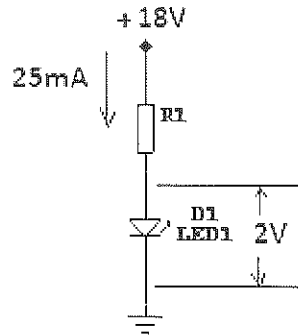
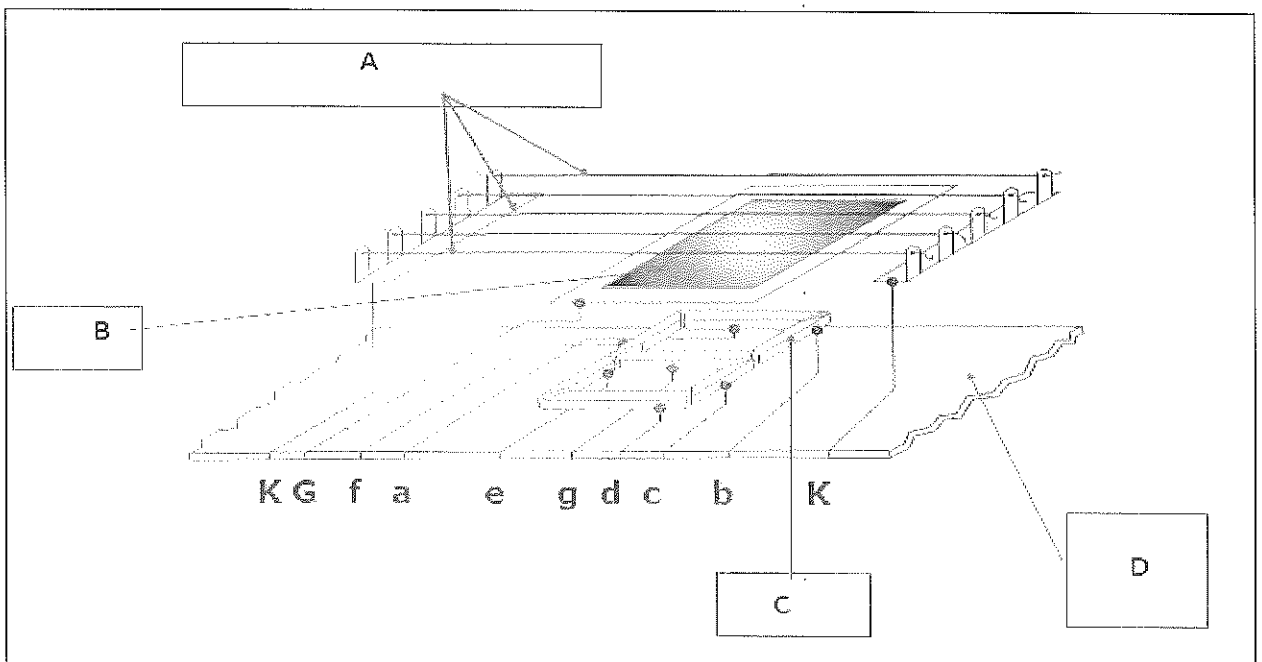


Fig – 3a

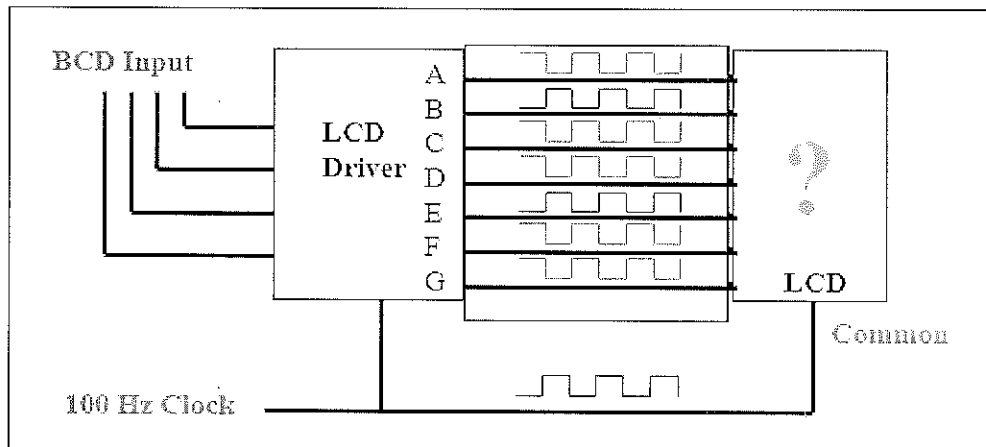
(3 marks)

- ii) Identify the following displays and label them.

(5 marks)



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



3. Name 4 display devices apart from LED, LCD and VFD. (4 marks)

SECTION F

TOPIC 5

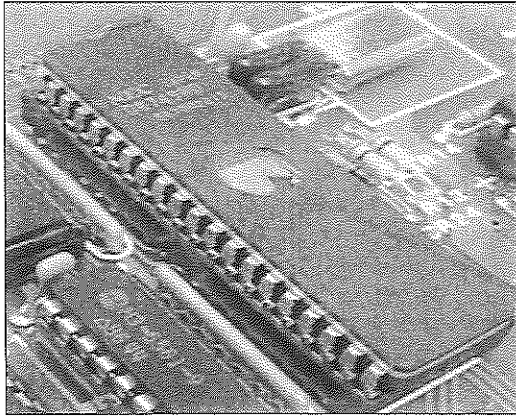
[10 marks]

For question number 1 below, choose the best answer from 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.
2. What is volatile and non-volatile memory? (2 marks)
3. Which two units make up the central processing unit? (2 marks)
4. Identify the IC given below. (1 mark)



(i)

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

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Examination Period		
Duration of Examination		
Instructions		
Total Number of Pages		
Other Pages		
Footer	Page Number	
	Unit Code	
	Examination Period	
Last Page		
The End		
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Proper Print		
Examination Requirements (FNU/E-1)		
Moderator's Report (FNU/E-3)		
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