DUBLIN CITY UNIVERSITY

May 1999

COURSE:	APPLIED PHYSICS PHYSICS with a LANGUAGE
YEAR:	2
SEMESTER	2
EXAMINATION:	Electronics 2; PS206
EXAMINER:	Dr B. Lawless
DURATION:	2 hours
INSTRUCTIONS:	Answer 5 parts of Question 1 (50 %) and 2 other questions (25 % each)

Do not turn over this page
until instructed to do so.

Question 1. Answer five parts of this question.

(a) Explain the operation of the NOR gate circuit shown in Figure 1.

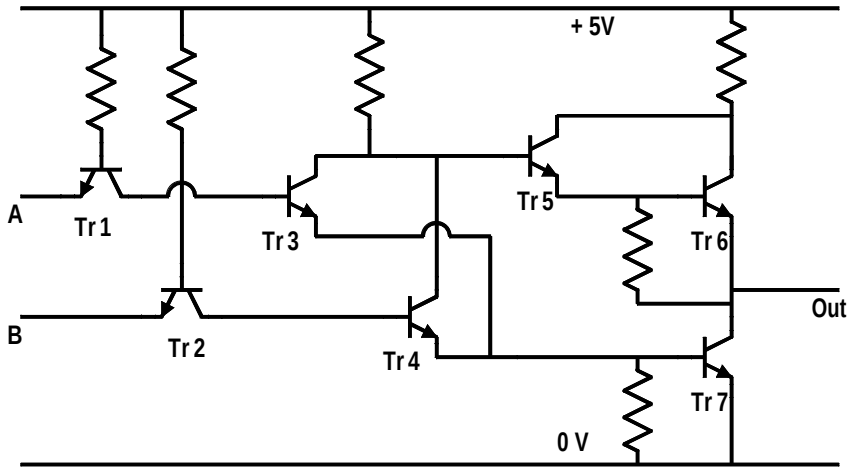

Figure 1: Question 1 (a)

(b) The physical structure of a Schottky transistor is shown in Figure 2. Explain the operation of this device and draw the equivalent circuit diagram of the device.

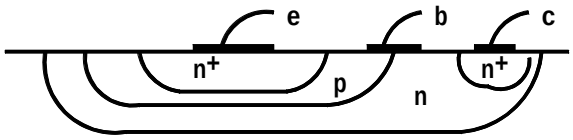

Figure 2: Question 1 (b)

(c) Give a brief description of ECL technology and explain the advantages of using ECL integrated circuits.

(d) Construct the truth table for the circuit shown in Figure 3

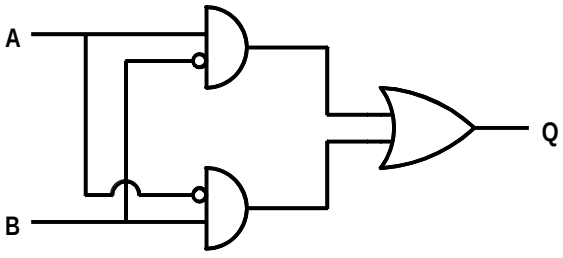

Figure 3: Question 1 (d)

(e) Convert 2000_D to hexadecimal and convert $4004BC_H$ to decimal. Show all the details of the conversion steps in each case.

(f) Explain what is meant by each of the following terms:

i. Gray code.

ii. Self-complementing code.

iii. Cyclic number code.

iv. Reflective code.

(g) Write down the Boolean expression represented by the following truth table. Explain how you obtained the expression.

A	B	C	D	Q
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

Truth table for Question 1 (g).

(h) Draw the logic gate circuit represented by the following expression:

$$Q = A.\overline{B} + A.B.\overline{C} + \overline{A}.B.C$$

Question 2. A particular logic application problem has been specified in the form of a minterm list given by:

$$Q = \Sigma m(1, 5, 6, 9, 14, 22, 25, 27, 30)$$

Using this information you are to:

(a) Draw up the truth table for the system.

(b) Construct the Boolean expression for the system.

(c) Construct the Maxterm list for the system.

(d) Simplify the Boolean expression using any suitable method.

(e) Draw a circuit diagram for the logic gate circuit.

Question 3. Describe, with the aid of circuit diagrams, the construction and operation of each of the flip flop types in the list below.
Show how the problems of indeterminacy associated with each of these flip flop types is addressed by the next type in the list.

(a) RS flip flop.

(b) D type flip flop.

(c) Clocked D type flip flop.

(d) JK flip flop.

(e) Master slave flip flop.

Question 4. (a) Distinguish between Moore and Mealy models of sequential machines.

(b) Explain what is meant by "State Table".

(c) Explain what is meant by "State Diagram".

(d) Construct the state diagram for the Moore circuit state table shown below:

	Input		Output
Present state	X = 0	X = 1	
A	B	A	0
B	E	F	1
C	D	B	1
D	C	A	0
E	A	D	0
F	E	C	1

Moore circuit state table

Question 5. Give an account of the operation of the R/2R digital to analog converter. What are the advantages of this circuit configuration when the network is manufactured as an integrated circuit?
Explain how this D/A converter can be used in a feedback loop in order to implement an analog to digital converter and discuss the algorithms which are used to control the D/A converter in the feedback loop.

Question 6. Write explanatory notes on each of the following:

(a) Serial data communication used to transfer data with RS232 protocol and using ASCII code.

(b) Centronics parallel printer port.

(c) A modem connection on a serial port used for data transfer over the PSTN.

(d) An interface card in a PC using a 8255 PIO for interfacing to and controlling external equipment.