DUBLIN CITY UNIVERSITY

Autumn 2001

COURSE:	APPLIED PHYSICS PHYSICS with a LANGUAGE
YEAR:	2
SEMESTER	2
EXAMINATION:	PS206: Electronics 2
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 ttl NOR gate integrated circuit shown in Figure 1. What is meant by the term "current sinking logic"?

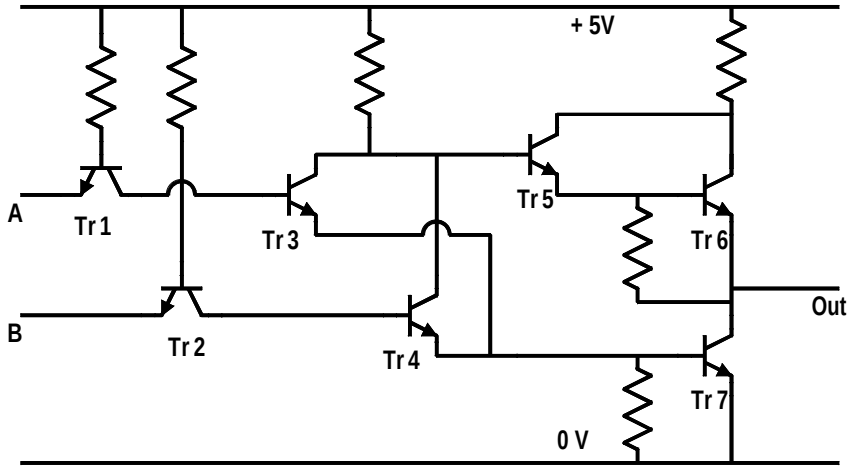

Figure 1: Question 1(a)

(b) Explain the operation of Schottky diodes. How does the use of Schottky diodes enable ttl circuits to operate at higher speeds?

(c) Carry out the following conversions and explain the method in each case.

i. Convert 703710_D to Hexadecimal.

ii. Convert $7D1C_H$ to Decimal.

iii. Convert 89_D to Gray code.

iv. Convert 366_D to Binary.

v. Get the negative of $48AB1_H$

(d) Explain how the use of parity bits can permit the detection of errors when data is transmitted.

(e) Draw the logic gate circuit implementation of:

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

(f) Derive the Boolean logic expression which describes the circuit in Figure 2.

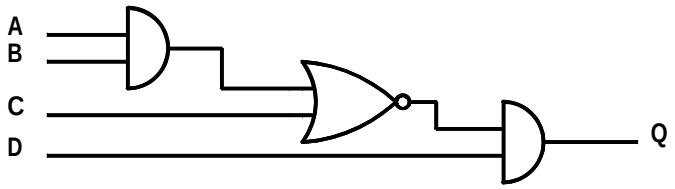

Figure 2: Question 1(f)

(g) Draw a circuit which implements the system described by the truth table shown below:

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

Truth Table for Question 1 (g).

(h) Derive the minterm list for the following Boolean expression

$$\begin{aligned} Q &= \overline{A}.\overline{B}.\overline{C}.\overline{D} + \overline{A}.\overline{B}.\overline{C}.D + \overline{A}.B.C.D \\ &\quad + A.\overline{B}.\overline{C}.\overline{D} + A.B.C.\overline{D} + A.B.C.D \end{aligned}$$

Question 2. Draw the Karnaugh Map for the truth table shown below. Use the map to obtain a simplified Boolean expression for Q.
Draw the logic gate circuit which implements this Boolean expression.
Give the minterm list corresponding to this Truth Table.

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

Truth Table for Question 2.

Question 3. Explain, with the aid of circuit diagrams, the operation of a JK flip flop.
What is meant by toggling action and how does it arise in the circuit?
How can JK flip flops be used to construct counters?

Question 4. Discuss the operation of two of the following types of Analog to Digital converters, using flow charts and block diagrams where appropriate.

(a) Ramp type feedback converter.

(b) Successive approximation feedback converter.

(c) Flash converter.

(d) Integrating type converter.

Question 5. Explain the operation of a 555 Timer oscillator. Give a block diagram of the internal circuit blocks of the 555 Timer. Describe, with the aid of diagrams, the waveforms which you would observe with an oscilloscope which is connected to the timing capacitor and the output pin when the circuit is set up as a free running oscillator.