WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

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294/01

ELECTRONICS

MODULE TEST E2

FOUNDATION TIER

A.M. THURSDAY, 7 June 2007

(45 minutes)

For Examiner's use only

Total Mark	

ADDITIONAL MATERIALS

In addition to this examination paper you may need a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** *questions*.

1. There are three types of electronic subsystem, known as *Input*, *Process* and *Output*.
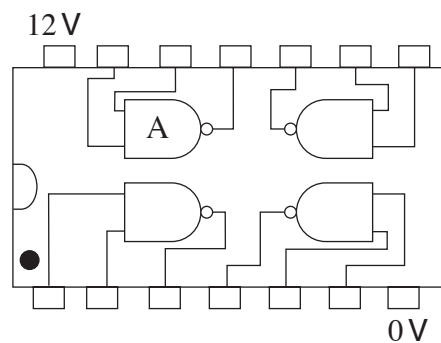
   Here are three subsystems:

Subsystem	Type *(Input, Process, or Output)*
Lamp unit	
Light Sensing Unit	
Comparator	

   For each one, decide which type it is.

   Add the word *Input*, *Process* or *Output* to show what you have decided. [3]

2. The diagram shows the pinout for an IC (integrated circuit.)

   12 V

   A

   0 V

   (a) How many logic gates are there on this IC? ....

   (b) How many inputs does each gate have? ....

   (c) Label pin 1 of the IC.

   (d) What is the number of the pin connected to the output of gate A? ....

   (e) Choose the type of logic gate found on this IC from the following list:

   AND   OR   NOT   NAND   NOR

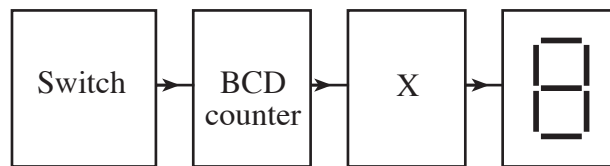   Answer ....

   [5]

3. *(a)* The diagram shows the arrangement of the LEDs in a seven-segment display.
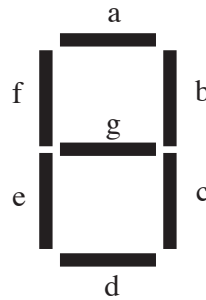
Complete the following table to show the number displayed when different segments are lit.
[3]

SEGMENTS							NUMBER DISPLAYED
a	b	c	d	e	f	g	
1					0		**7**
							9
1	1	1	1	0	0	1	

(b) Here is the block diagram for a counting system. The system shows how many times the switch has been pressed.

Switch → BCD counter → X → (seven-segment display)

Subsystem X converts the output of the counter to light the correct LEDs in the seven-segment display.

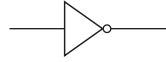Choose the best subsystem to do this from the following list: [1]

monostable   *decoder / driver*   *AND gate*   *transducer driver*

Answer ....

Turn over.

4. *(a)* Here is a list of logic gates:

AND   OR   NOT   NAND   NOR

(i) Which of the gates has the following symbol?

Answer .... [1]

(ii) Which of the gates has the following truth table?

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

Answer .... [1]

(iii) Which of the gates has the opposite effect to (inverts) an OR gate?

Answer .... [1]

(b) Complete the truth table for the following logic system: [2]
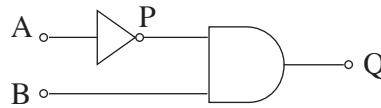
A	B	P	Q
0	0		
0	1		
1	0		
1	1		

5. The diagram shows a pulse generator and a D-type flip-flop.

```
┌──────────────┐              ┌──────────────┐
│    Pulse     │           ──┤ D        Q ├──
│  generator   │──            │              │
└──────────────┘           ──▷ Clock        │
                              │            ─ │
                              │            Q ├──
                              └──────────────┘
```
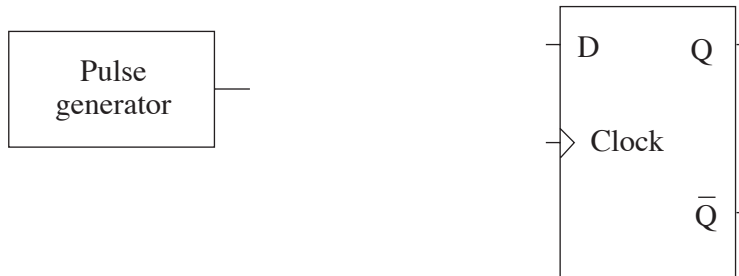
(a) Draw the two connections needed to make the D-type perform a divide-by-two action.   [2]

(b) The frequency of the signal at the Q output is 100 Hz.

    (i) What is the frequency of the $\overline{Q}$ output?   ....

    (ii) What is the frequency of the pulse generator output?   ....   [2]

(c) The D-type flip-flop is rising-edge triggered.

    (i) Label a rising-edge on the pulse generator output graph.   [1]

    (ii) The Q output is initially at logic 1.
          Complete the graph to show the signal at the Q output.   [3]

    (iii) Draw the graph to show the signal at the $\overline{Q}$ output.   [1]

Turn over.
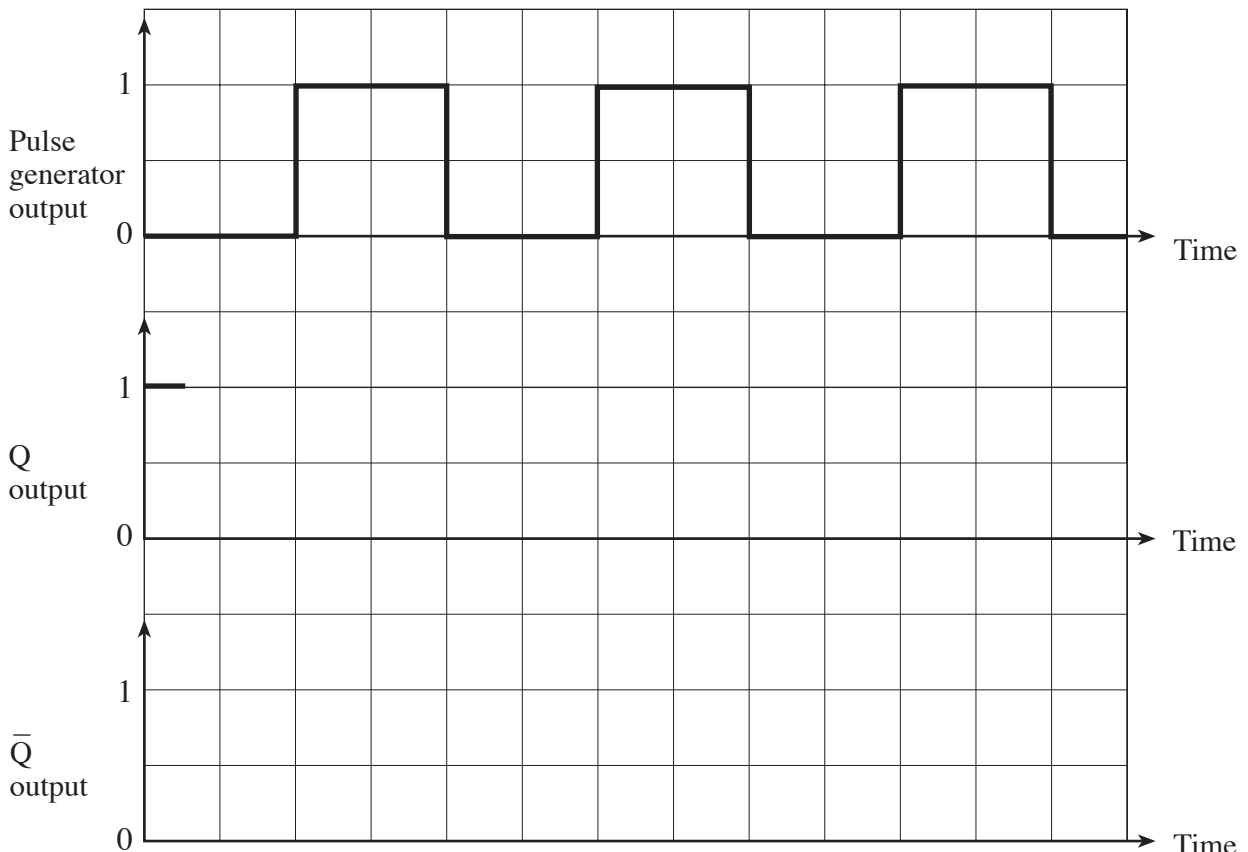
6. The block diagram shows a system which generates a sequence of lights.
The sequence repeats over and over again.
It uses a memory IC to store the sequence.
The pulse generator and counter select each memory location in turn.
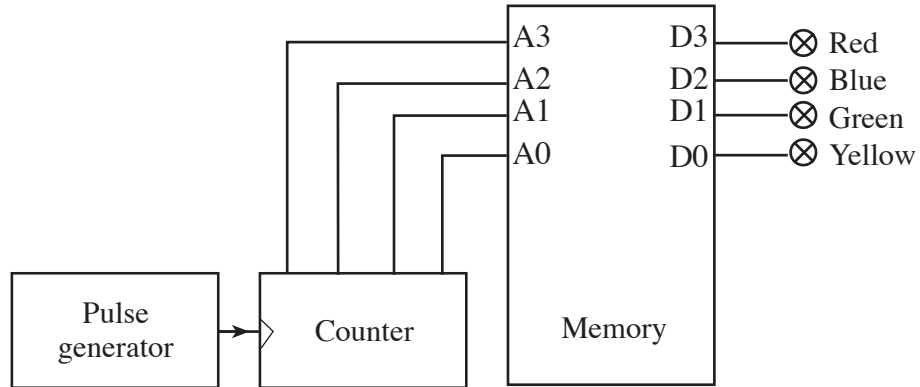
The memory stores the following data:

Address				Data			
A3	A2	A1	A0	D3	D2	D1	D0
0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0
0	0	1	0	1	1	0	0
0	0	1	1	1	1	1	0
0	1	0	0	1	1	1	1
0	1	0	1	Reset			

(a) The pulse generator has a frequency of 1Hz.
Which of the following shows the output signal from the pulse generator?
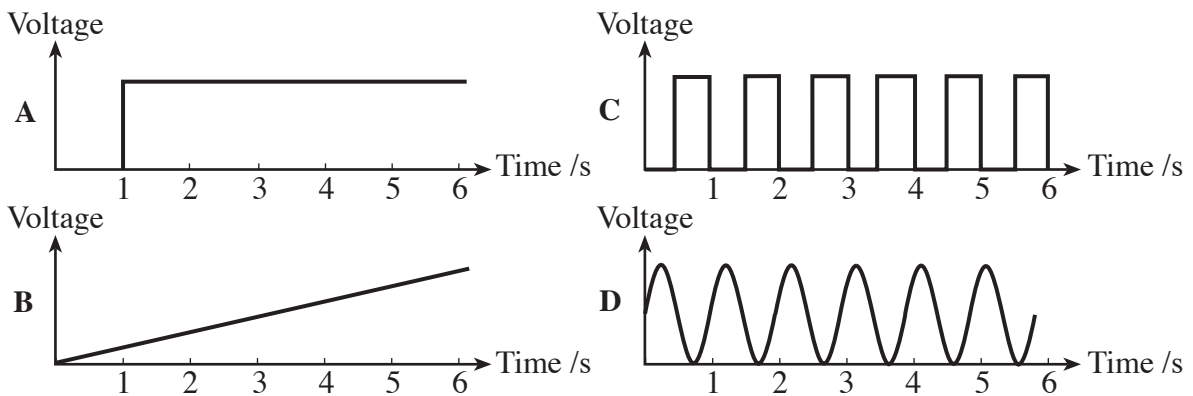
Answer .... [1]

(b) Complete the following table by adding either *Off* or *On* to show the sequence of lights produced by the system. [4]

Red	Blue	Green	Yellow
Off			

(c) The counter resets when the reset pin receives a logic 1 signal.
Output A is the least significant bit of the counter output.
Complete the circuit diagram to make the counter reset when the output reaches 0101. [3]

Turn over.
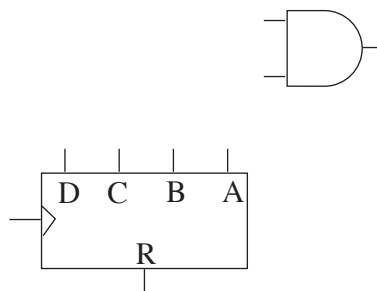
7. A logic system has two input sensors, **A** and **B**, and three outputs **P**, **Q** and **R**.
The truth table is shown below.

B	A	P	Q	R
0	0	1	1	1
0	1	1	1	1
1	0	1	1	0
1	1	1	0	0

(a) Which output can be produced by connecting one of the inputs to a NOT gate? [1]

....

(b) Which output does not need a logic gate to produce it? [1]

....

(c) Look at the remaining output. It is produced by connecting inputs **A** and **B** to a logic gate.
What kind of logic gate is needed? [1]

....

(d) Complete the diagram to show how this logic system can be made. [3]

Logic 1 ————————————————

                                                    ——— **P**

   A ———

                                                    ——— **Q**

   B ———

                                                    ——— **R**

Logic 0 ————————————————