

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
 General Certificate of Education
 Advanced



CYD-BWYLLGOR ADDYSG CYMRU
 Tystysgrif Addysg Gyffredinol
 Uwch

384/01

ELECTRONICS

ET4

P.M. WEDNESDAY, 24 January 2007

(1¼ hours)

ADDITIONAL MATERIALS

In addition to this examination paper you will 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** questions.

Write your answers 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.

You are reminded of the necessity for good English and orderly presentation in your answers.

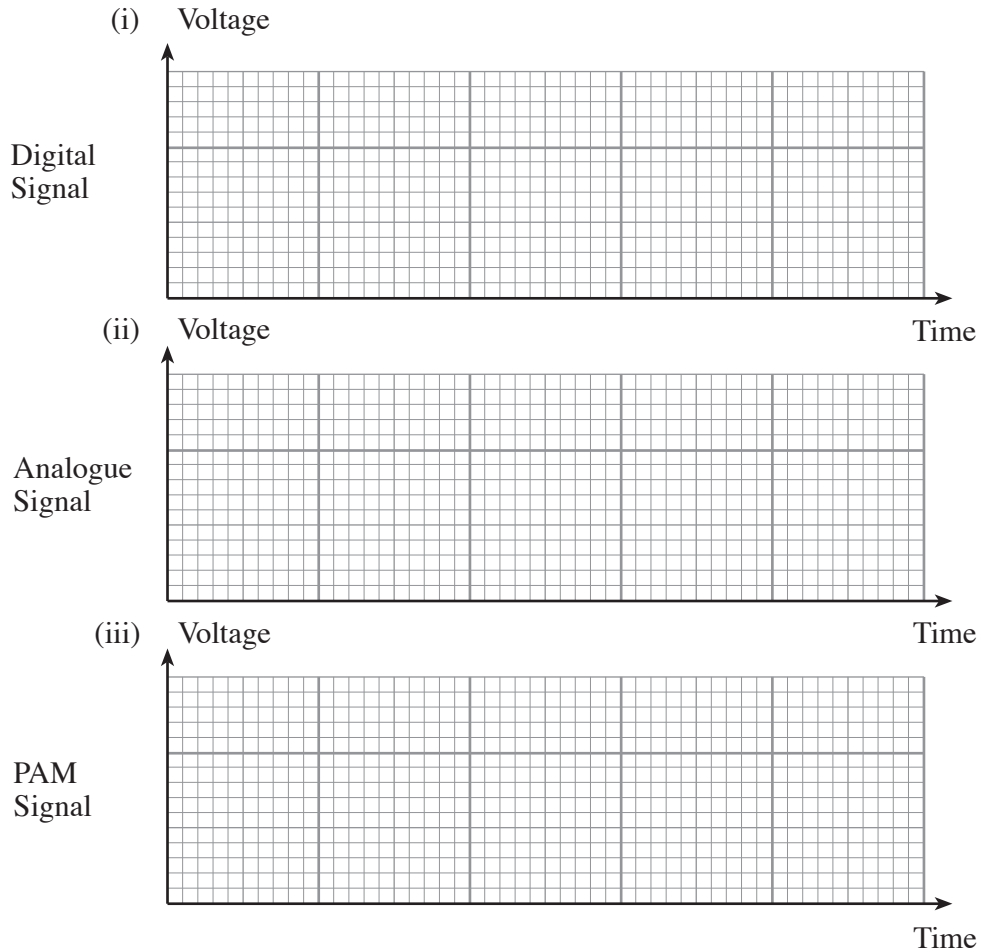
For Examiner's use only.	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

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

1. (a) Use the axes below to sketch an example of the following signals.

- (i) A digital signal.
- (ii) An analogue signal.
- (iii) A pulse amplitude modulated signal.

[3]



(b) Without considering cost or quantity of information carried, state two advantages of digital systems over analogue systems.

- 1.
- 2.

[2]

2. The internet is an example of a packet-switched network.

(a) Four of the statements below are true for a packet-switched network. One statement is false.

- A. Messages can be stored and forwarded at quieter times.
- B. Large messages are split up into a number of smaller numbered fragments.
- C. A dedicated circuit is maintained between the source and destination until the whole message is transmitted.
- D. Other messages can share the communication link.
- E. This type of network uses the TCP/IP protocol suite, to direct the message from source to destination.

The FALSE statement is [1]

(b) What is the function of a router in the internet?

.....

.....

..... [1]

(c) One IP address in binary is as follows:

10001000 11001101 00110010 10001001

Convert the binary IP address above into *dotted decimal notation*.

..... [2]

(d) (i) Which of the following IP addresses cannot be converted into a 32-bit binary address.

- A. 200.192.17.6
- B. 27.6.109.30
- C. 136.178.6.0
- D. 112.78.200.271
- E. 92.255.7.11

The IP address that cannot be converted is [1]

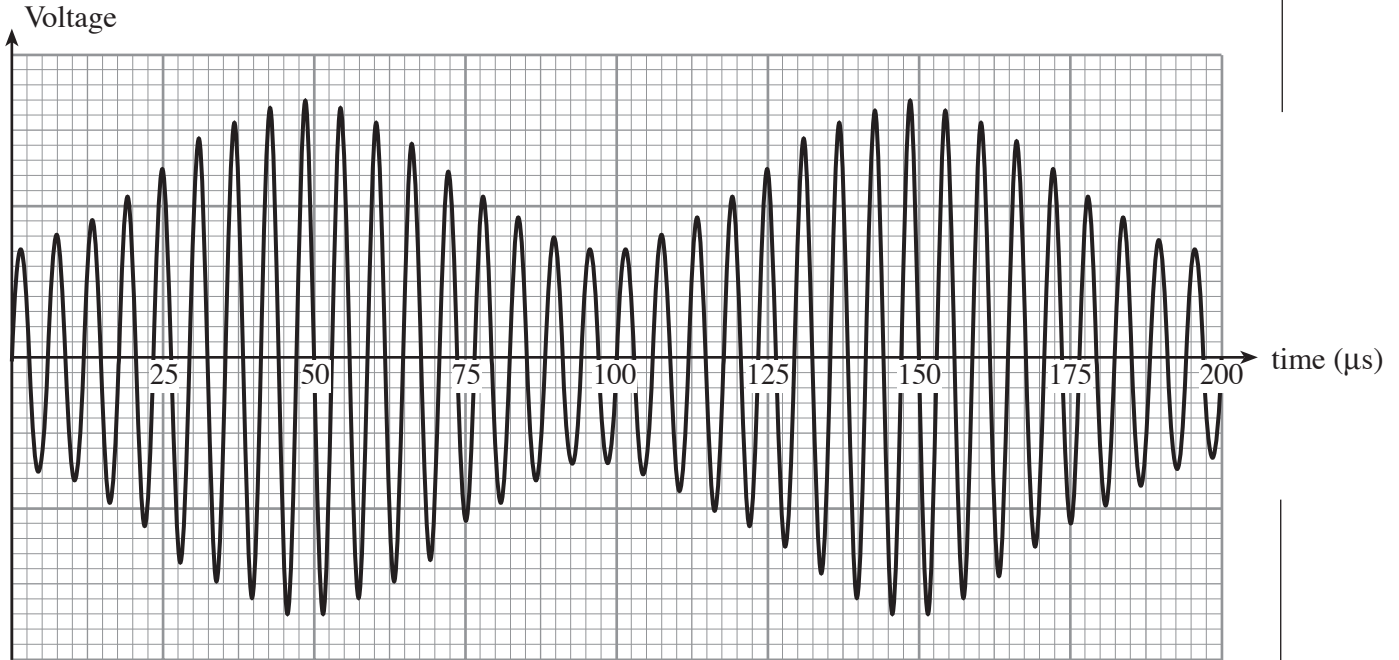
(ii) Explain why your answer to (d)(i) cannot be converted into a 32-bit address.

.....

.....

..... [1]

3. A carrier wave is amplitude modulated by a single frequency test signal and broadcast by a radio station. An engineer received the following signal on the receiving circuit.



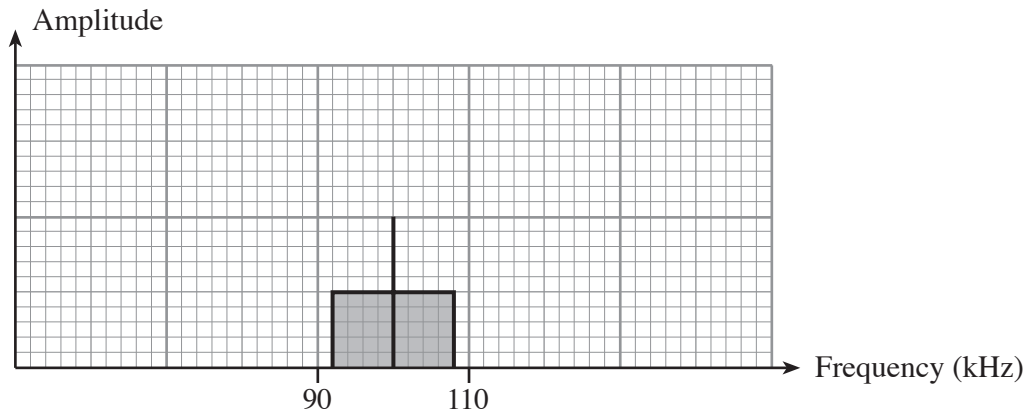
- (a) Determine the period and frequency of the test signal.

Period:

Frequency:

[2]

- (b) The single frequency test signal is now replaced by an audio signal. The carrier frequency is also changed. The frequency spectrum of this broadcast is shown below.



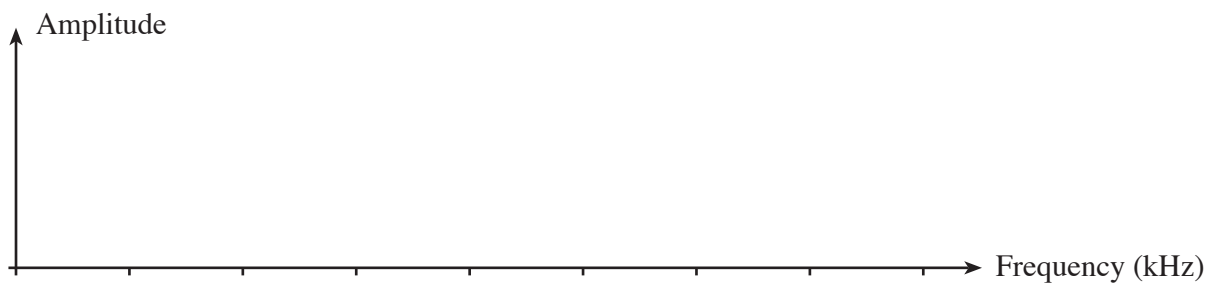
- (i) What is the carrier frequency of the radio station?

.....
[1]

- (ii) What is the broadcast bandwidth of this transmission?

.....
[1]

- (iii) Use the axes provided to sketch the frequency spectrum for the **audio signal** being transmitted. Label the frequency axis with the appropriate scale.

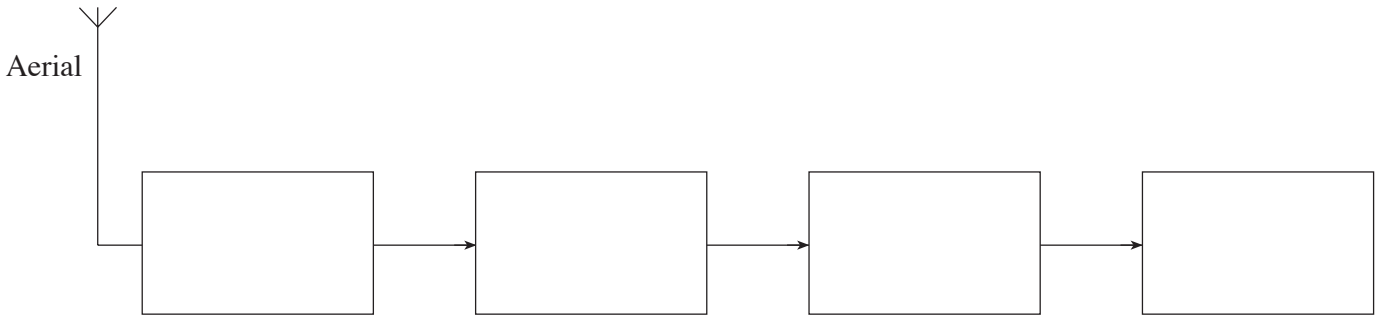


[2]

4. A simple radio receiver is made from the following sub-systems.

Detector/Demodulator Tuned Circuit Headphones RF Filter

(a) (i) Complete the block diagram of the simple radio receiver, using the subsystems above.



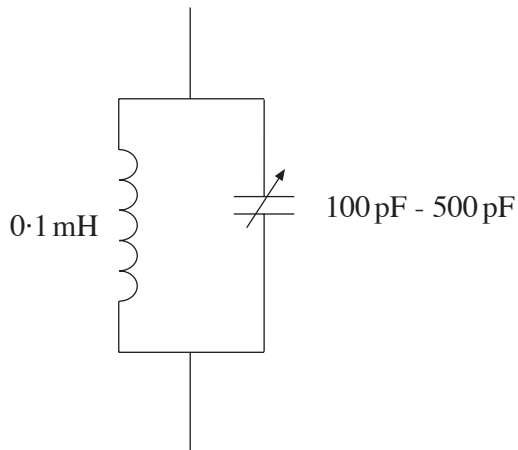
[1]

(ii) Name the component used as the detector in the simple radio receiver.

.....

[1]

(b) The circuit diagram of the *tuned circuit* is shown below.



(i) *Valleys Radio* transmits on a carrier frequency of 999 kHz. Calculate the reactance of the inductor at 999 kHz. Give the unit.

.....
.....
.....

[3]

(ii) State the reactance of the variable capacitor when the circuit is tuned to pick up *Valleys Radio*.

..... [1]

(iii) Calculate the value of the variable capacitor when receiving *Valleys Radio*.

.....
.....
..... [2]

(c) The simple radio receiver suffers from poor *selectivity* and *sensitivity*. What is meant by poor *sensitivity*?

.....
.....
..... [1]

(d) Name the section of the superheterodyne radio receiver which improves the *sensitivity* of the receiver.

..... [1]

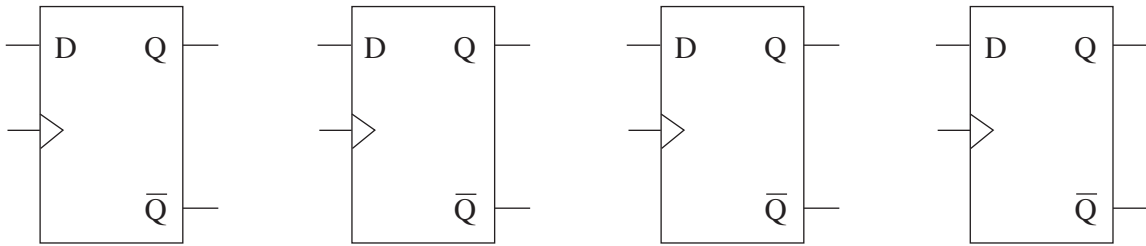
5. (a) How many clock pulses does it take to output an 8-bit number from
- (i) an 8-bit SIPO (serial-in-parallel-out) shift register?
 - (ii) an 8-bit PISO (parallel-in-serial-out) shift register?

[2]

(b) Complete the following circuit diagram for a 4-bit SIPO shift register.

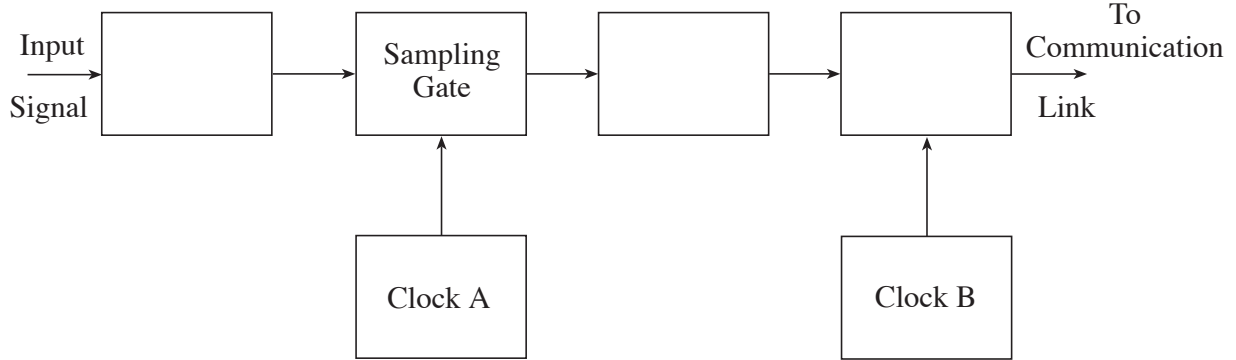
Label:

- (i) the serial input
- (ii) the clock input
- (iii) one of the parallel outputs.



[4]

6. The block diagram below shows a transmitter for a Pulse Code Modulation (PCM) system which is used in a telephone exchange.



- (a) Complete the block diagram by correctly labelling the missing blocks. [3]
- (b) The highest frequency present in the input signal is 4 kHz. Choose from the list of possible frequencies below two frequencies that could be used for clock A to enable the signal to be regenerated without distortion.

1.0 kHz 1.5 kHz 4.0 kHz 5.5 kHz 7.0 kHz 8.5 kHz 10.0 kHz

Frequency 1:

Frequency 2:

[2]

- (c) Several PCM systems can be combined using *Time Division Multiplexing*. Explain what is meant by *Time Division Multiplexing*.

.....

.....

.....

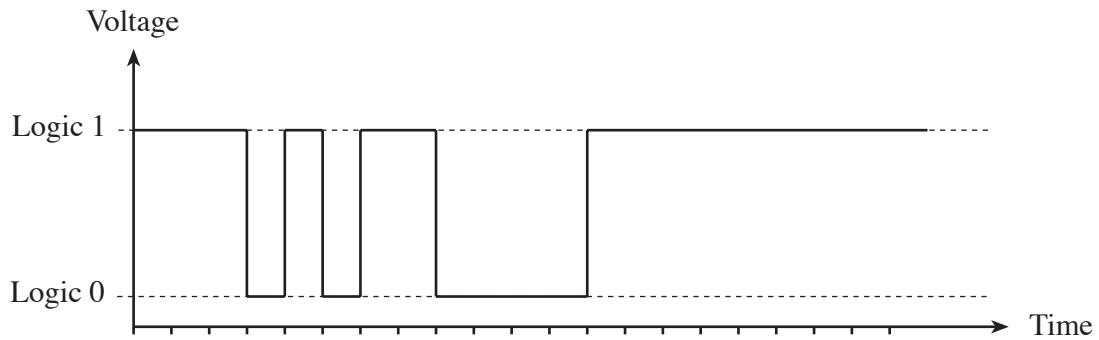
.....

.....

[2]

7. The graph shows the waveform of a signal received down an asynchronous serial communication link using **odd** parity.

The signal carries the ASCII code for an alphanumeric character.



The signal includes start and stop bits, a parity bit, and 7 data bits corresponding to the ASCII character.

- (a) Label the start bit and the parity bit. [2]

- (b) Write down the 7 bit character code.

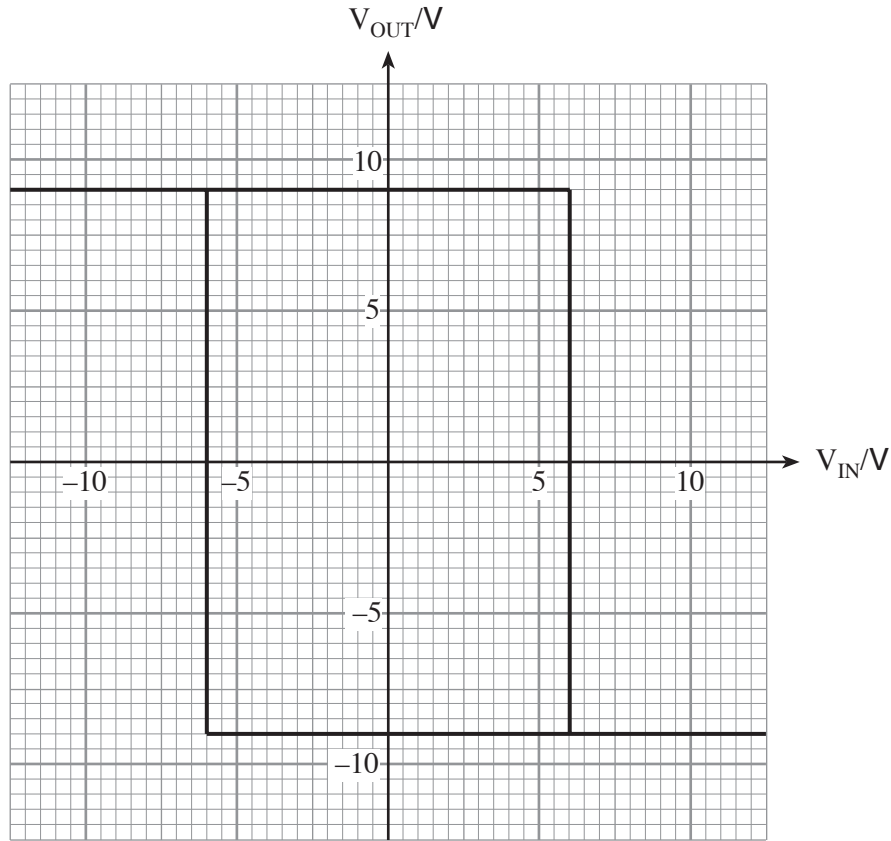
..... [2]

- (c) Determine whether the signal contains an error. Explain how you reached your conclusion.

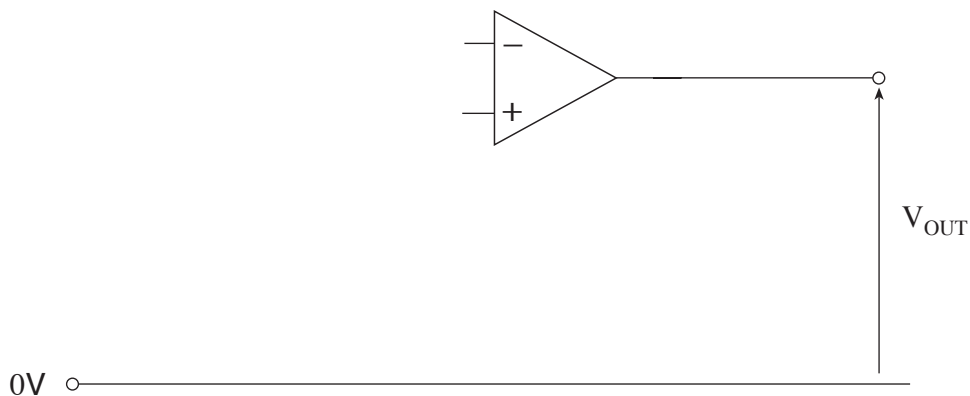
.....

[1]

8. A Schmitt trigger circuit has the following input/output characteristic when connected to a $\pm 10\text{V}$ power supply.



- (a) (i) What is the value of V_{IN} that causes V_{OUT} to change from -9V to $+9\text{V}$?
- (ii) What is the value of V_{IN} that causes V_{OUT} to change from $+9\text{V}$ to -9V ? [1]
- (b) Design a suitable circuit for this Schmitt trigger based on an op-amp running on a $\pm 10\text{V}$ supply. The op-amp output saturates at $\pm 9\text{V}$. Calculate suitable values for any resistors used and mark these on the circuit diagram.



[4]

Turn over.

