

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

- (a) The mark scheme gives some guidance as to what statements are expected to be seen in a 1 or 2 mark (L1), 3 or 4 mark (L2) and 5 or 6 mark (L3) answer. Guidance provided in section 3.10 of the '*Mark Scheme Instructions*' document should be used to assist marking this question.

L3 5-6 marks	All three bullet points of the question are addressed in good detail.	The student presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible.
L2 3-4 marks	The answer includes some discussion of two or three of the three bullet points.	The student presents relevant information and in a way which assists the communication of meaning. The text is legible. Sp&g are sufficiently accurate not to obscure meaning.
L1 1-2 marks	The answer addresses one bullet point in some detail but the others may be neglected.	The student presents some relevant information in a simple form. The text is usually legible. Sp&g allow meaning to be derived although errors are sometimes obstructive.
0 marks	Little or no discussion of relevant content.	The student's presentation, spelling, punctuation and grammar seriously obstruct understanding.

The following statements could be present:

- description of variable amplitude of AM carrier wave
- description of variable wavelength of FM carrier wave.

For AM :

- amplitude of carrier wave varies at frequency of superimposed

signal whilst frequency (or wavelength) of carrier wave is constant

- advantages of AM:
 - modulation is simpler to produce so equipment is less complex
 - fewer transmitters needed
- disadvantages of AM
 - more subject to interference and distortion
 - waveband has limited capacity.

For FM:

- frequency of carrier wave varies at frequency of superimposed signal whilst amplitude of carrier wave is constant
- advantages of FM:
 - less prone to interference
 - clearer reception
 - waveband has greater capacity
- disadvantages of FM:
 - signal less diffracted because of shorter wavelength so more difficult to receive
 - require more transmitters.

6

(b) $\lambda \left(= \frac{c}{f} \right) = \frac{3.00 \times 10^8}{434 \times 10^6} = 0.691 \text{ (m)} \checkmark$

Length of aerial = 0.173 (m). $\checkmark$

2

(c) At 4 °C $f = 7.3(6\theta + 273)$ gives $f = 7.3(6 \times 4 + 273) = 2170 \text{ Hz} = 2.2 \text{ (kHz)} \checkmark$

1

(d) Bandwidth calculation based on higher frequency signal f_H i.e 3.0 kHz $\checkmark$ required bandwidth = $2 f_H = 6.0 \text{ kHz} \checkmark$

2

[11]

Q2.

- (a) No pd across 100 k Ω (since no current through it) so both inputs are 0 V / logic 0 and output there for logic 1. $\checkmark$

1

(b) $\left(V = V_0 \left(1 - e^{-\frac{t}{RC}} \right) \right)$ and $RC = 10 \text{ s}$ gives $2.5 = 5.0 \left(1 - e^{-\frac{t}{10}} \right) \checkmark$

Solution gives $t = 6.93 \text{ s} \checkmark$

2

- (c) Any appropriate time delay application that leaves a device switched ON or OFF for a short time after activation or deactivation. $\checkmark$

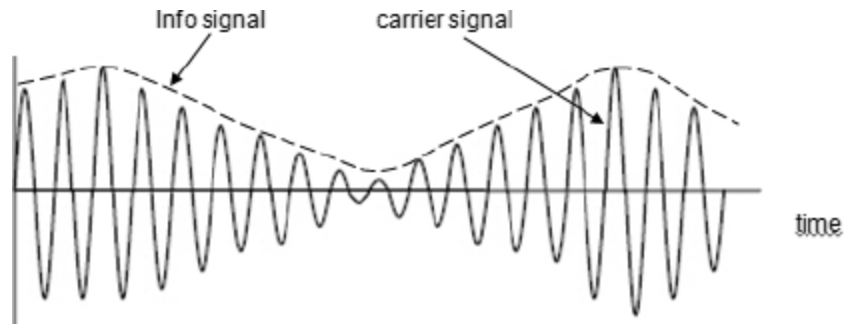
e.g. Car interior light as driver leaves vehicle, intruder alarm exit delay.

1

[4]

Q3.

- (a) amplitude of carrier varies in phase with information / audio signal ✓
accept labelled diagram in support



1

- (b) $2 \times 2.2 \text{ kHz} = 4.4 \text{ kHz}$ ✓

1

- (c) requires a large bandwidth so would limit the number of channels / stations if low frequency carriers were used ✓

1

- (d) Noise distorts the amplitude of signals which is difficult to reduce in am ✓
In fm the original signal can be recovered as long as the frequencies in the BW are detectable since no information in the amplitude. ✓
In AM receivers signals and noise are amplified equally.
ANY TWO

2

[5]