AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Electronics 5431/6431

ELE5 Communications Systems

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Unit ELE5 – Communications Systems

1 (a)
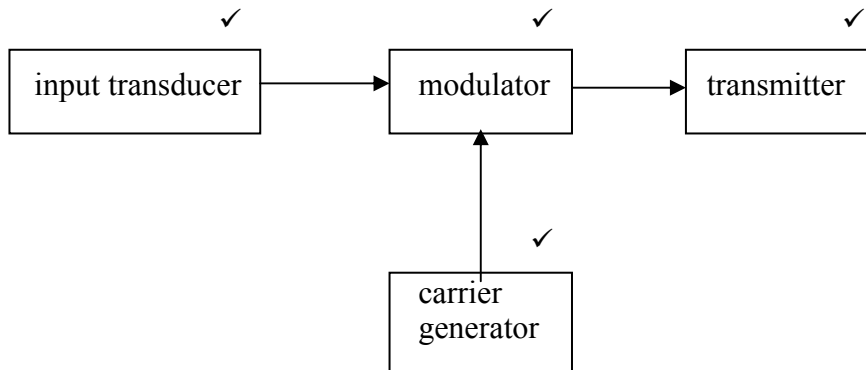
(4 marks)

    (b)   (i)   optic fibre✓
                      uses light waves as carrier, very high frequency✓

             (ii)   free space (allow radio)✓
                      no wires or fibres to move✓

             (iii)   optic fibre✓
                      cannot be tapped easily without communicators knowing✓
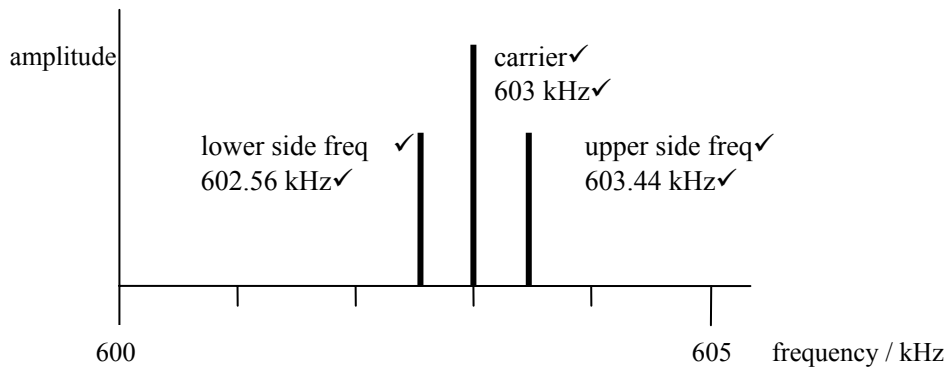
(6 marks)
(question total 10)

2 (a)   amplitude of carrier fluctuation✓
             rate of change of carrier amplitude fluctuation✓

(2 marks)

    (b)   amount of frequency deviation✓
             rate of change of frequency deviation✓
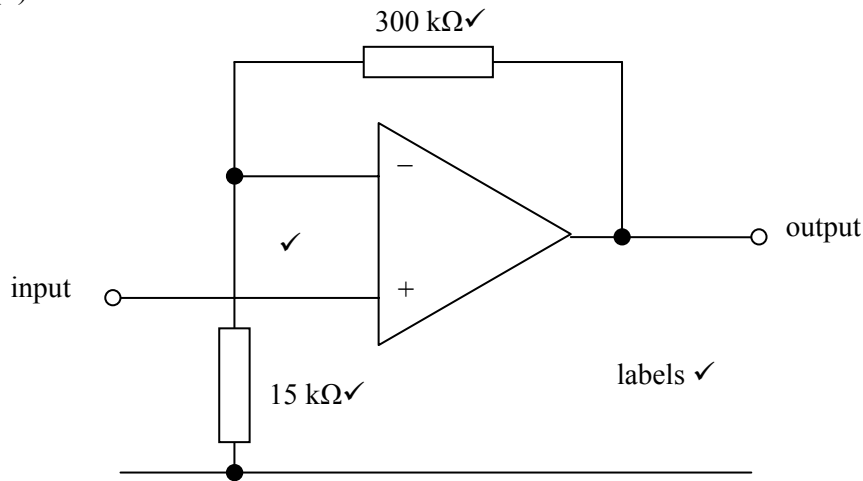
(2 marks)

    (c)

(6 marks)
(question total 10 marks)

3   (a)   non-inverting (amplifier)✓

(1 mark)

(b)

300 kΩ✓

✓

$-$

input

$+$

output

labels ✓

15 kΩ✓

(4 marks)

(c)   (i) $G_v = 1 + R_f/R_1 = 1 + 300/15$✓ $=$ 21✓

(ii)   21 x 25✓   = 525mV✓

(4 marks)

(d) $10^6/21 = 48$ kHz✓
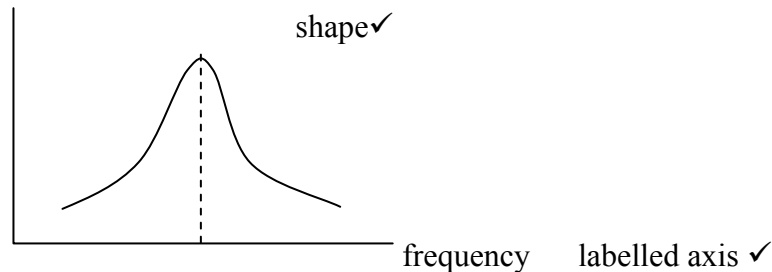
(1 mark)
(question total 10 marks)

4   (a)   (i)   selecting required frequency or tuning✓

(ii)   improve selectivity or reject unwanted signals better✓

(iii)   use of $f = 1/ 2\pi\sqrt{LC}$ $1/ 6.28\sqrt{50 \times 10^{-6} \times 300 \times 10^{-12}}$✓
1.3MHz✓

(iv)   amplitude (impedance)

shape✓

frequency   labelled axis ✓

(6 marks)

(b)   (i)   sensitivity✓

(ii)   rf amplifier✓

(2 marks)
(question total 8 marks)

5 (a) examples only

      (i) Analogue is more prone to noise✓
           Digital signals are encoded✓
           Analogue uses superhets, digital uses logic gates✓

      (ii) Digital is better, noise can be removed✓
           Digital is more secure✓
           Digital uses simpler circuits✓

(6 marks)

  (b) TDM✓   FDM✓ (any order)

(2 marks)
(question total 8 marks)

6 (a) (i) optic fibre✓

      (ii) total internal reflection✓

      (iii) attenuation✓ dispersion✓ (any order)

      (iv) $V_r = 12 – 2 = 10V$✓ $R = V_r/I = 10/0.01 = 1000\Omega$✓

(6 marks)

 (b) (i)
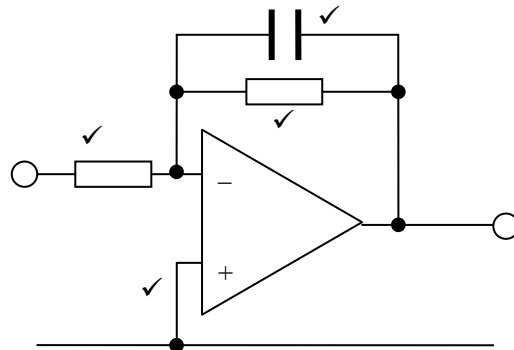
      (ii) either calculate the reactance of C at 4 kHz and show it to be
           nearly equal to R_f, or use of formula for breakpoint frequency.
           Use of correct formula✓   numerical substitution✓
           answer✓

      (iii) -✓   3.9✓

      (iv) 8 kHz✓
           sampling rate must be at least twice highest signal frequency✓
           one sample positive, one negative for highest frequency✓
           or diagram, or anti-aliasing

(12 marks)
(question total 18 marks)

7   (a)   Data on D input is sent to Q✓ when clock signal goes high✓

(2 marks)

(b)
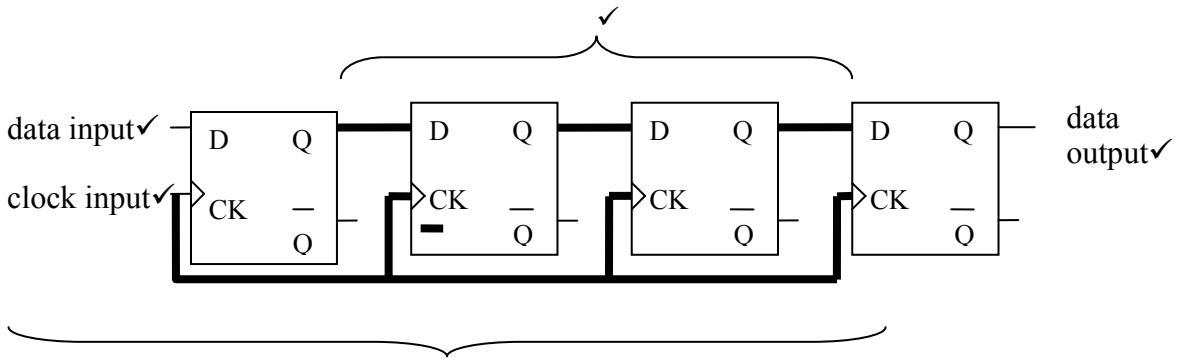
(4 marks)

(c)   serial✓ only one connection/channel required✓

(2 marks)
(question total 8 marks)