# GCE 2004
*June Series*

ASSESSMENT and QUALIFICATIONS ALLIANCE

# Mark Scheme

## Electronics
*5431/6431 (ELE5)*

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## ELE5 – Communications Systems

**1**

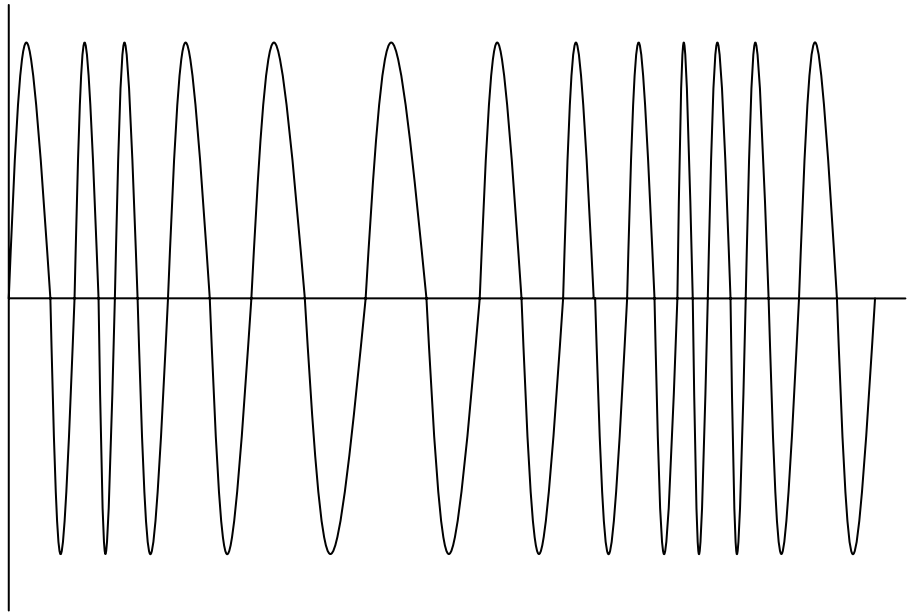
(a) input transducer✓ modulator✓ transmitter✓
receiver✓ demodulator✓ output transducer✓ (6 marks)

(b) any wired system✓ optical fibre✓ radio waves✓ (3 marks)

**(Total 9)**

**2**

(a)



constant amplitude✓ varying frequency✓ in phase with info✓ (3 marks)

(b) 2 x (15 + 75) ✓ = 180 kHz✓ (2 marks)

(c) (i) $\lambda = 3 \times 10^8 / 100 \times 10^6$✓ = 3m✓
3/2 = 1.5 m✓

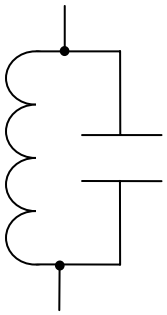
(ii) 75 Ω✓ (4 marks)

**(Total 9)**

**3**

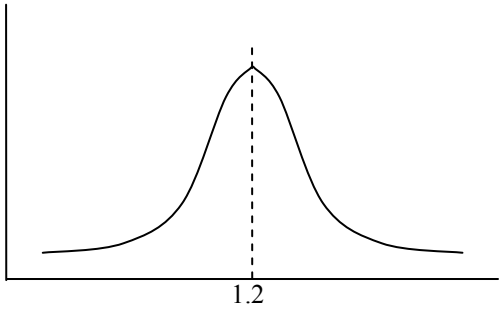
(a) antenna✓ demodulator✓ audio amp✓ loudspeaker✓ (4 marks)

(b) (i)



capacitor symbol✓
inductor symbol✓
parallel circuit✓

(ii)




resonant frequency✓
correct shape✓

(iii) $L = \frac{1}{4\pi^2 f^2 C}$ ✓

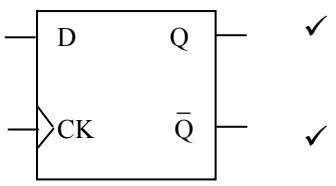
$= \frac{1}{4 \times 9.87 \times 1.44 \times 10^{12} \times 500 \times 10^{-12}}$ ✓

$= 35\ \mu H$ ✓ (8 marks)

**(Total 12)**

**4**

(a) ✓




✓ ✓ ✓

(4 marks)

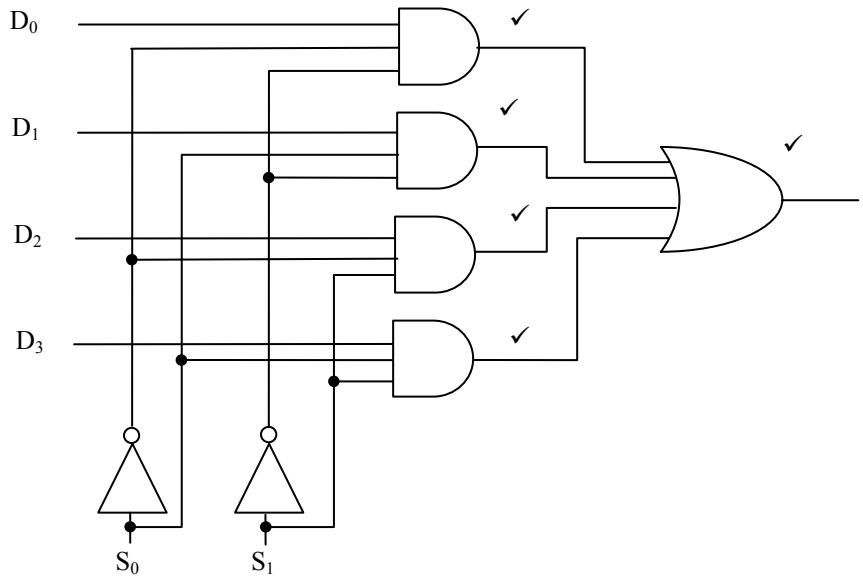
(b) data on D input is sent to Q✓ when clock goes high✓ (2 marks)

(c) all clock inputs wired together✓ Q to D between stages✓ (2 marks)

(d) serial data into first D input✓
parallel data out of all the Q outputs✓
after correct number of clock pulses✓ (3 marks)

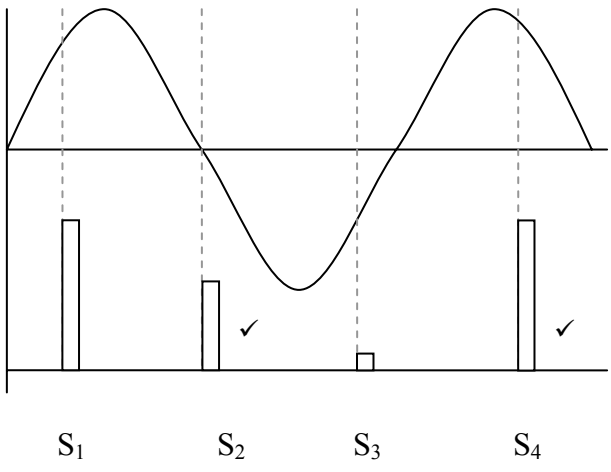
**(Total 11)**

**5**




**(Total 5)**

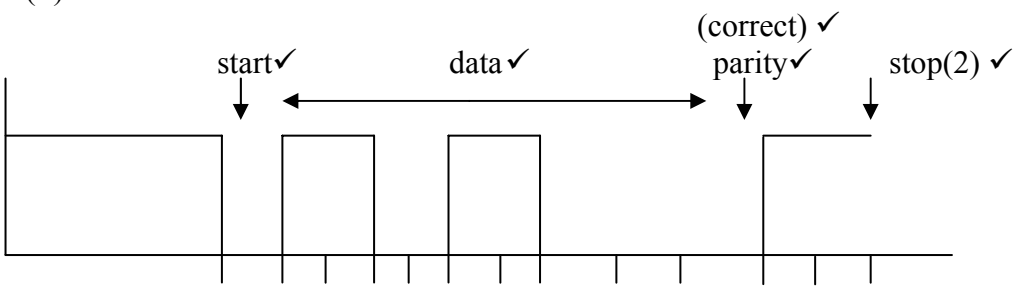
**6**
(a)




(2 marks)

(b) (i) 256✓

(ii)




(6 marks)

**(Total 8)**

**7**

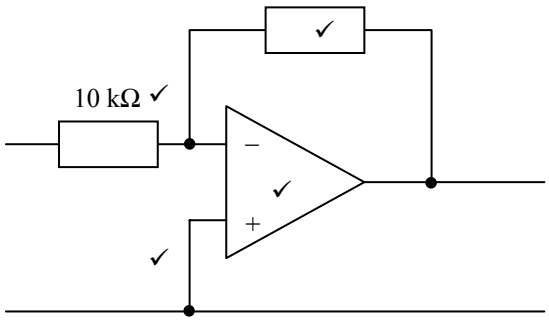
(a) laser diode (allow LED) ✓ (1 mark)

(b) total internal reflection✓ (1 mark)

(c) photo diode (allow phototransistor) ✓ (1 mark)

(d) absorption✓ scattering✓ (2 marks)

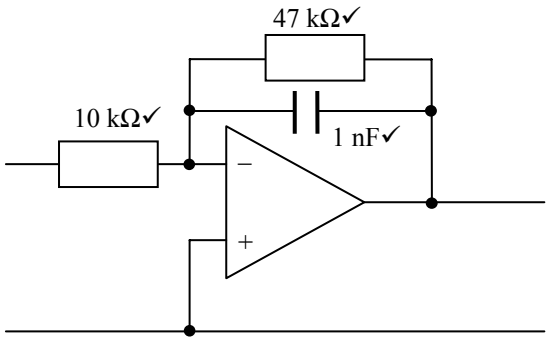
(e) (i) e.g.




gain; 1/ 0.025 = 40✓
feedback resistor; 40 x 10 k = 400 kΩ✓

(ii) gain-bandwidth product✓ (7 marks)

(f) (i)




(ii) $f = \frac{1}{2\pi RC}$ ✓

$= \frac{1}{6.28 \times 47 \times 10^{3} \times 10^{-9}}$ ✓

$= 3.4$ kHz ✓ (6 marks)

**(Total 18)**

**(Paper Total 72)**