Communication

Mark Scheme 6

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Communication
Sub Topic	
Paper Type	Theory
Booklet	Mark Scheme 6

Time Allowed: **59 minutes**

Score: **/49**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 (a) e.g. signal can be regenerated M1
so that there is minimal noise A1
e.g. extra data can be added M1
so that signal can be checked for errors ..... A1 [4]
(*any two, sensible suggestions, M1 + A1, max 4*)

(b) (1101 ..... B1 [1]

(ii) 5 ..... B1 [1]

(c) (block X: serial-to parallel B1
block Y: DAC / digital-to-analogue (converter) ..... B1 [2]

(ii) takes the simultaneous / all bits of a number M1
and transmits them one after another / down a single line ..... A1 [2]

(d) increase number of bits in digital number at each sampling M1
so that step height is reduced A1
increase sampling <u>frequency</u> / reduce time between samples M1
so that depth / width of step is reduced ..... A1 [4]
(*do not allow 'smoother output'*)

[Total: 14]

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2 **(a)** amplitude modulation ……(*allow AM*) ..... B1 [1]

(b) (frequency = 1 / period C1
= 100 kHz ..... A1 [2]

(ii) frequency = 10 kHz ..... A1 [1]

(c) (vertical line at 100 kHz B1
vertical lines at 90 kHz and 110 kHz B1
lines at 90 kHz and 110 kHz same length and shorter than at 100 kHz ..... B1 [3]

(ii) 20 kHz ..... B1 [1]

[Total: 8]

3 **(a)** **(i)** base stations ..... B1 [1

(ii) cellular exchange ..... B1 [1

(b) base station / X sends / receives signal to / from handset B1
call relayed to cellular exchange / Y (and on to PSTN) B1
computer at cellular exchange monitors signal from base stations B1
selects base station with strongest signal B1
allocates a (carrier) frequency / time slot for the call ..... B1 [5]

[Total: 7]

4 **(a)** loss / reduction in power / energy / voltage/ amplitude (of the signal) B1 [1]

(b) **(i)** attenuation = 125 × 7 = 875 dB [1]

(ii) 20 amplifiers
gain = 20 × 43 = 860 dB [1]

(c) gain = $10 \lg(P_1/P_2)$ C
overall gain = –15 dB / attenuation is 15 dB
$-15 = 10 \lg(P / 450)$
P = 14 mW [3]

5 **(a)** switch; tuning cct; (r.f.) amplifier; demodulator;
serial-to-parallel converter; DAC; (a.f.) amplifier
mark as 2 sets of 2 marks each

5 blocks identified correctly	B2	
(each error or omission, deduct 1 mark)		
5 blocks in correct order	B2	[4]
(4 or 3 blocks in correct order, allow 1 mark)		

(b) phone transmits signal (to identify itself) (1)
signal received by (several) base stations (1)
transferred to cellular exchange (1)
computer selects base station with strongest signal (1)
assigns a (carrier) frequency (1)
(any four, 1 each, max 4) B4 [4]

6 **(a** IR has less attenuation (per unit length) B1
fewer (repeater) amplifiers / longer uninterrupted length B1 [2]

(b) *either* limited range B1
(so) cells do not overlap (appreciably) B1 [2]
or short wavelength (B1)
so convenient length aerial (on mobile phone) (B1)

(c) large bandwidth / large information carrying capacity B1
different so that uplink signal not swamped by downlink B1 [2]

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