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General Certificate of Education (A-level)
June 2013

Electronics ELEC5

(Specification 2430)

Unit 5: Communications Systems

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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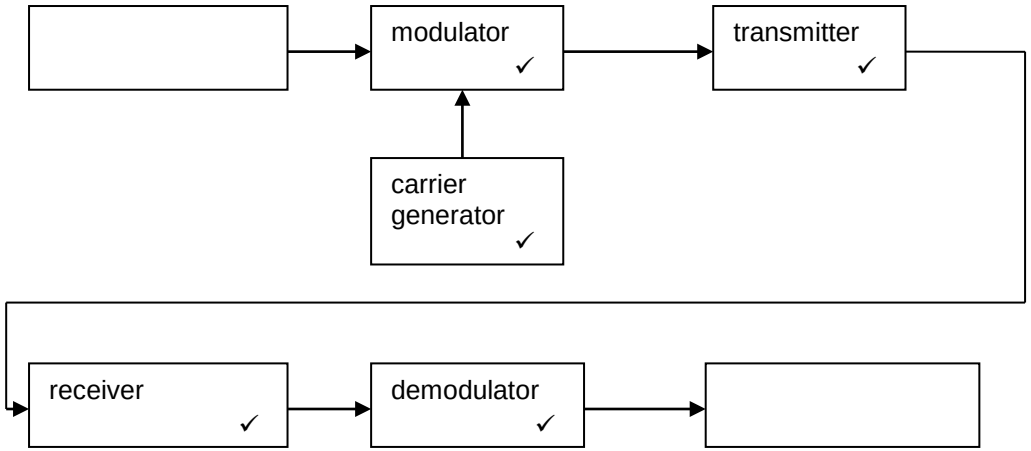
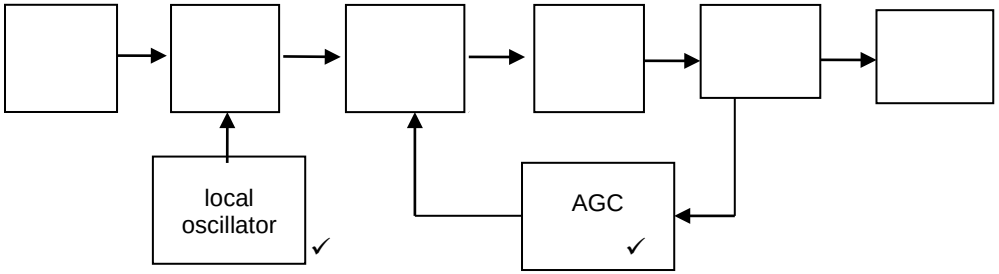
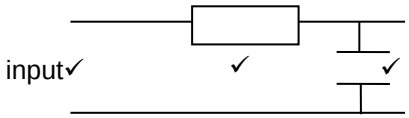
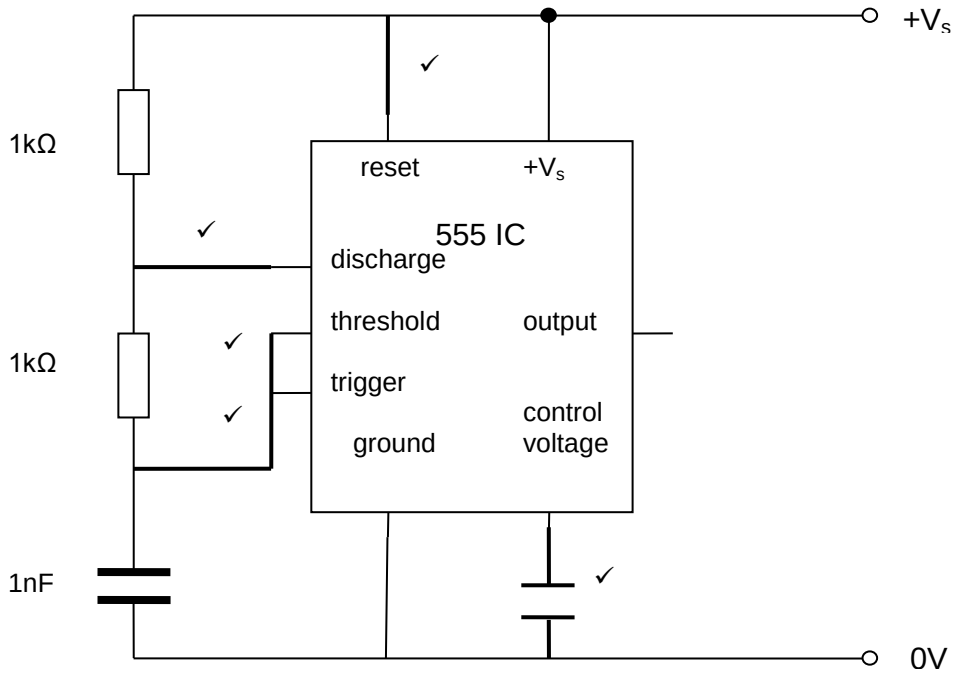
Question	Part	Subpart	Marking guidance		Mark
1	(a)		(any order) 1 free space✓ 2 wires (twisted pair, coaxial etc.) ✓ 3 fibre✓		**3**
1	(b)				**5**
2	(a)				**2**

2	(b)		examples of answers: radio frequency amplifier✓, increases amplitude of the signal at the actual carrier frequency✓. intermediate frequency amplifier✓, increases amplitude of signal mixed downwards in frequency✓. audio frequency amplifier✓, increases amplitude of baseband audio signal, after demodulation✓.		**6**
2	(c)	(i)	112.1 – 101.4 = 10.7 MHz✓		**1**
2	(c)	(ii)	112.1 + 10.7✓ = 122.8 MHz✓		**2**
3	(a)		very high frequency ✓		**1**
3	(b)	(i)	frequency of carrier wave✓ varied to correspond with audio signal ✓		**2**
3	(b)	(ii)	less noise on signal✓		**1**
3	(c)		$\lambda = c/f$ = $3x10^8$ / $156.3x10^6$✓ = 1.9m✓ $\lambda/2$ = 0.96m✓		**3**
3	(d)		to match impedance✓ of aerial (to source / free space)		**1**
3	(e)		only one direction at a time ✓ one person speaks at a time/ need to hand over from one to other ✓		**2**
3	(f)		2 of: one freq used by ship✓ one used by shore ✓ both can speak at same time ✓ (max 2 marks)		**2**
3	(g)		less bandwidth means only a lower range of frequencies can be transmitted ✓		**1**
4	(a)		Data is sent one bit at a time✓ Data can be sent both ways down the cable✓, but only one way at a time✓		**3**

4	(b)	(i)	3 + 2x8 + 64x8 + 8 + 8 ✓; =547✓		2
4	(b)	(ii)	547/480,000,000✓; =1.14µs✓		2
4	(c)	(i)	Total file size = 1,450MB + 13.5MB + 0.8MB = 1,464.3MB✓ total packets needed = 1464.3 x 10^6 / 64✓ = 22,879,688 pkts✓		**3**
4	(c)	(ii)	Time needed = 22,879,688 x 1.14 x 10^{-6} = 26 secs✓		**1**
4	(d)		Bluetooth or IR link ✓quicker/no wire✓		**2**
4	(e)		Magnetic field caused by signal cancels out✓ not possible to radiate or pick up other signals✓		**2**
5	(a)		Low pass filter✓		**1**
5	(b)				**4**
5	(c)		use of 1/2RC✓ = 1/ 6.28 x 10^4 x 10^{-8} ✓= 1.6 kHz✓		**3**
5	(d)		not suitable✓ cuts off frequencies from too low a frequency✓		**2**
6	(a)		by radio signal✓ via base station✓ cellular network✓ frequency re-use at distance✓ multiplexing✓		**5**
6	(b)		repeater can be analogue or digital✓ it amplifies signal and passes it on✓ regenerator digital only✓ it restores logic levels✓		**4**

7	(a)				**5**

7	(b)		$t_H = 0.7 \times 2 \times 10^3 \times 10^{-9} = 1.4 \times 10^{-6}$s✓✓ $t_L = 0.7 \times 10^{-6}$s✓		**3**

7	(c)		upper graph, square wave, high time correct, ✓ low time correct✓ lower graph, edges dispersed✓, amplitude reduced✓		**4**

7	(d)		spreading due to dispersion✓ lower amplitude due to attenuation causes (any) ✓		**2**