A-LEVEL
ELECTRONICS

Communications Systems ELEC5
Mark scheme

2430
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Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

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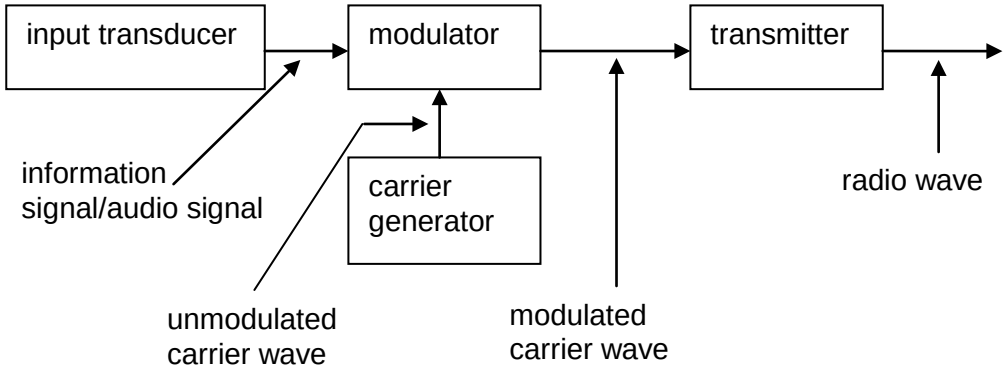
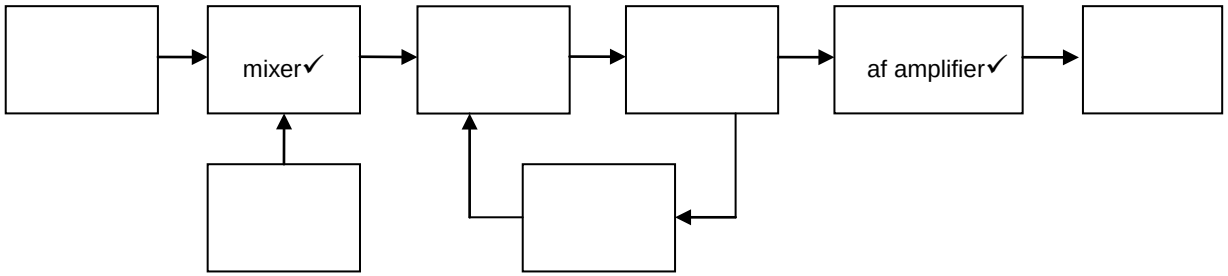
COMPONENT NUMBER: ELEC5

COMPONENT NAME: Communications Systems

Question	Part	Sub part	Marking Guidance	Mark	Comments
1	(a)			8	1 mark per box or label
1	(b)		Examples twisted pair - noise cancellation as induced voltages oppose✓ little cross-talk between different pairs✓ opposing fields reduce radiation/attenuation✓ least secure✓ coaxial cable – used at UHF e.g TV aerial downfeed✓ screens e.m. interference✓ is bulky✓ optic fibre - highest bandwidth✓ highest security✓ difficult to intercept signals✓ tampering would be evident✓ interfacing is more complicated✓	6	Comments should be correct.

2	(a)			2	
2	(b)	(i)	to produce the intermediate frequency signal ✓from the rf signal✓ by combining✓ the rf signal with the lo signal (in a non-linear stage) ✓	3 max	
2	(b)	(ii)	increases the amplitude of the audio frequency signal ✓	1	
2	(c)	(i)	1.455 – 0.455 = 1 MHz✓	1	
2	(c)	(ii)	1.455 + 0.455 = 1.910 MHz✓	1	
2	(c)	(iii)	**Example** It is another response of a superhet receiver✓ generated by the fact that a mixer will generate both sum and difference products✓	2	
3	(a)	(i)	ultrahigh frequency✓	**1**	
3	(a)	(ii)	frequency modulation✓	1	

3	(a)	(iii)	The instantaneous amplitude/voltage of the information signal✓ determines variations in the frequency of the carrier wave✓	2	
3	(b)	(i)	300 / 446.09375✓ = 67.25 cm✓	2	
3	(b)	(ii)	67.25 cm / 4 = 16.8 cm✓	1	
3	(c)	(i)	**Example** 446.01875 – 446.00625 = 12.5 kHz✓	1	
3	(c)	(ii)	2(3 + 2.5) ✓ = 11 kHz, less than 12.5 kHz✓	2	
3	(c)	(iii)	signal would occupy more than the channel width, (calculation = 16kHz) ✓ so interference would be created on adjacent channels✓	2	
3	(d)		Only one channel available for both transmission and reception✓ so both ends of the communication will have to “take turns” ✓	2	
4	(a)	(i)	Signal should be sampled at twice its max frequency (Nyquist) ✓ Otherwise aliasing will occur✓	2	
4	(a)	(ii)	low pass filter /treble cut filter✓	1	
4	(a)	(iii)	calculation leading to 64kbps✓	1	

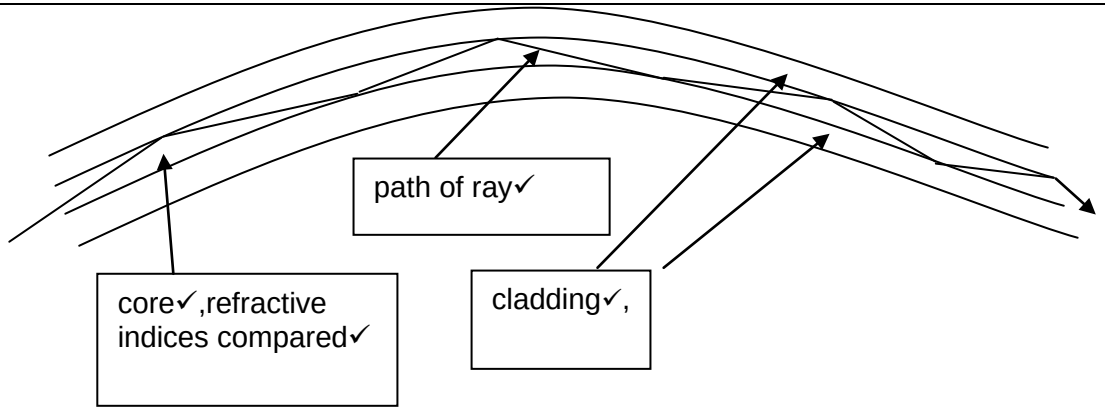
4	(b)		parallel to serial converter, or shift register✓	1	
4	(c)	(i)	7 bits x 160 characters = 1120 bits✓ / 8 = 140 bytes✓	2	
4	(c)	(ii)	(140x8) / 64000 ✓= 0.0175 sec, 17.5 ms✓	2	
4	(c)	(iii)	**Examples** checksum, parity bits, destination address, originator address ✓	1 max	
5	(a)		**Example** noise: random/unrelated to signal ✓ present even when no input ✓ distortion: related to signal ✓ introduces extra frequencies ✓ not present when no signal ✓	4 max	
5	(b)		5mV ✓ 4ms ✓ 250Hz ✓	3	
5	(c)		distortion✓ noise would be present at zero input✓	2	
5	(d)		60 = 20 log ($4/V_{noise}$) ✓ rearrange ✓ V_{noise} = 4mV ✓	3	
6	(a)		20Hz ✓ – 20kHz ✓	2	

6	(b)	(i)	bass cut / high pass✓ treble cut / low pass✓	2	

6	(b)	(ii)	The frequency at which the response starts to fall (**or equivalent**)✓	1	

6	(b)	(iii)	correct formula ✓ correct substitution ✓ correct handling of units ✓ [159.2Hz]	3	

6	(b)	(iv)	correct formula and correct rearrangement ✓ 33(.2)nF ✓	2	

7	(a)			4	

7	(b)		laser diode or LED✓	1	

7	(c)		mention of Total Internal Reflection✓	1	

7	(d)		Scattering: rays being deflected by impurities/discontinuities in fibre✓, it results in attenuation of the signal✓ Dispersion: rays taking different paths of differing lengths✓, so spreading the signal out in time✓	4	