2014 Electronic and Electrical Fundamentals

Intermediate 2

Finalised Marking Instructions

Part One: General Marking Principles for: Electronic and Electrical Fundamentals Intermediate 2

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question.

(a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader/Principal Assessor.

(b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

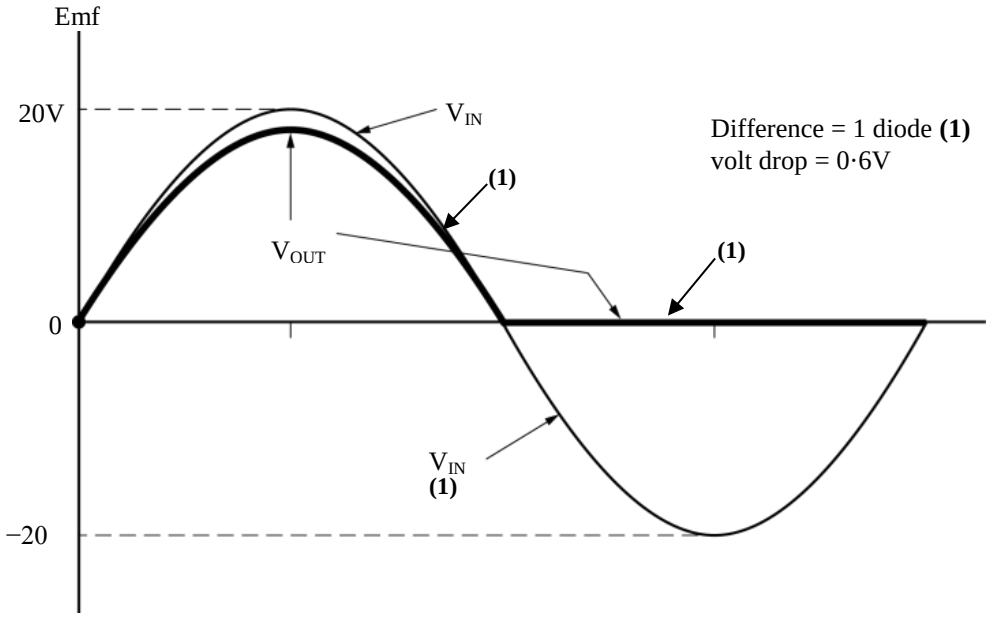
GENERAL MARKING ADVICE: Electronic and Electrical Fundamentals Intermediate 2

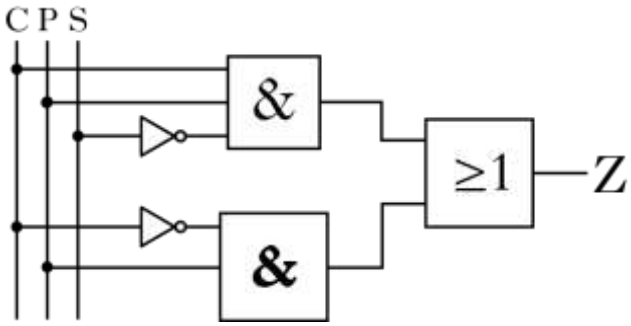
The marking schemes are written to assist in determining the "minimal acceptable answer" rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates' evidence, and apply to marking both end of unit assessments and course assessments.

Part Two: Marking Instructions for each Question

Section A

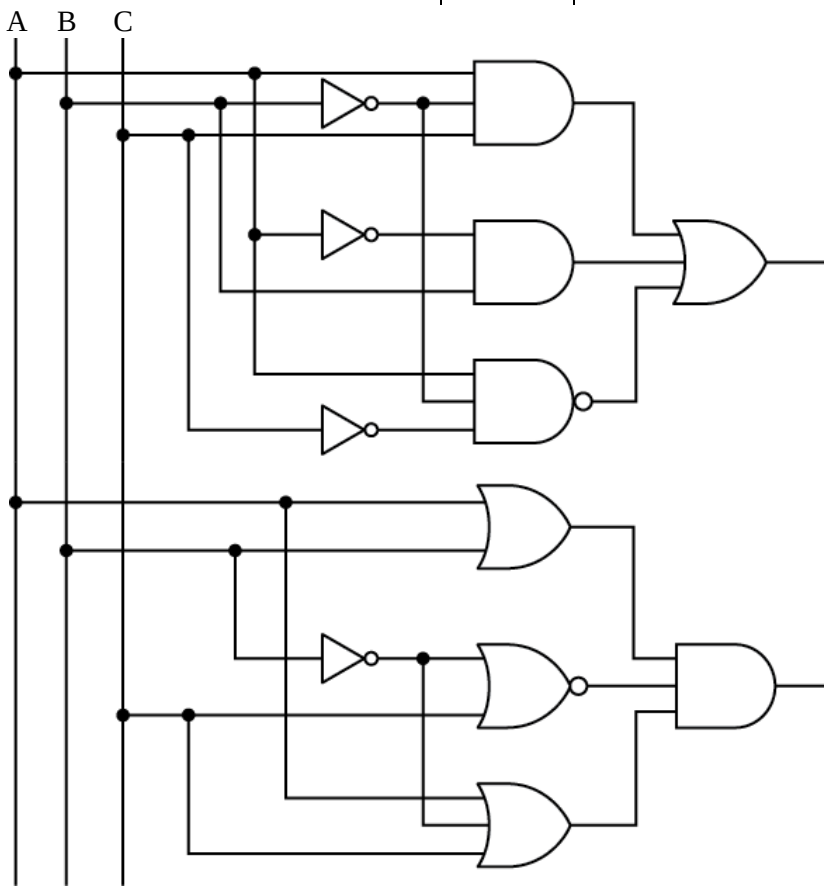
Question			Expected Answer(s)	Max Mark	Additional Guidance
1.	**(a)**		253_{10}	**2**	
1.	**(b)**		170_{10}	**2**	
1.	**(c)**		11000111_2	**2**	
				(6)	
2.			By KVL the voltage drop V_{CD} = 40 – 25 – 5 = **10V** By Ohms Law the supply current = V_{CD}/R_{CD} = 10/10 = 1A Therefore V_{BD} = 1 *R_{BD} = 1 *30 **= 30V**	**1** **3**	
				(4)	
3.	**(a)**		F = BLI therefore **B = F / LI** F = 25N; I = 3A; L = 750mm = 0·75m B = 25/(0·75 * 3) +**11·11T**	**1** **2**	
3.	**(b)**		The force **will increase** by the **same ratio ie *3 therefore new force 75N**	**2**	
				(5)	
4.	**(a)**		Vrms = Vmax * 0·707 = therefore Vmax = Vrms / 0·707 **= 141·4V**	**2**	
4.	**(b)**	**(i)**	e = Emax sinθ therefore e at 135º = 141·4 sin 135º = 100V	**2**	
4.	**(b)**	**(ii)**	e = Emax sinθ therefore e at 280º = 141·4 sin 280º = −139·3V	**2**	
				(6)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
5.	**(a)**		Non inverting amplifier	**1**	
5.	**(b)**		Gain = 1 + (R_2 / R_1) = 1 + 220 / 18 = **13·22**	**2**	
5.	**(c)**		V_{OUT} = V_{IN} × Gain = 45mV × 13·22 = **595mV**	**2**	
5.	**(d)**		Offset Null (or gain)	**1**	
				(6)	
6.	**(a)**		Thyristor, Power control; latching	**2**	
6.	**(b)**		Diac; triggering Triac light dimmer, motor control	**2**	
				(4)	
7.	**(a)**		Half wave rectifier	**1**	
7.	**(b)**			**4**	
7.	**(c)**		V_{RL} = V_S – (0·6*1) = 20 − 0·6 = 19·4V *NB. 0·7V for the diode is acceptable* I_{RL} = V_{RL} / 10 = 19·4 /10 = **1·94A**	**3**	
				(8)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
8.	**(a)**		NOR gate	**2**	
8.	**(b)**		Nand Gate	**2**	
				(4)	
9.	**(a)**		$G = C.P.\overline{S} + \overline{C}.P$ Can be expressed in other ways.	**3**	
9.	**(b)**		 Other answers or gates will be acceptable.	**3**	
9.	**(c)**		Diode or Thyristor or Rectifier	**1**	
				(7)	

Section B

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	**(a)**		I_1 = 1A I_2 = 10A I_3 = 5A I_4 = 5A I_5 = 0A I_6 = 6A I_7 = 10A	**7**	
10.	**(b)**	**(i)**	**Point A** = 6V	**1**	
		(ii)	**Point B** = 4·5V	**2**	
		(iii)	**Point C** = 2·5V	**2**	
10.	**(c)**	**(i)**	R_T = 10 + 30//20 + 18 = 10 + 12 + 18 = 40 Ω	**3**	
10.	**(c)**	**(ii)**	I_S = 10/40 = 0·25A	**1**	
10.	**(c)**	**(iii)**	I_{20} = (30 × 0·1)/20 = 0·15A	**2**	
10.	**(c)**	**(iv)**	P = VI = 10 × 0·25 = 2·5W	**1**	
10.	**(c)**	**(v)**	Energy = P × T = 2·5 × 90 × 60 = 13·5kJ	**2**	
10.	**(c)**	**(vi)**	10Ω is S/C and 20Ω is O/C	**4**	
				(25)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
11.	(a)	(i)	$\mathbf{0101_2 + 0111_2} = 1100_2$	2	
		(ii)	$\mathbf{0110_2 + 0011_2} = 1001_2$	2	
11.	(b)	(i)	$F = A.\overline{B}.C + \overline{A}.B + \overline{A,\overline{B}.\overline{C}}$	4	
11.	(b)	(ii)	$F = (A + B).\overline{(\overline{B} + C)}.(A + \overline{B} + C)$ 	4	

<table>
<tr><th colspan="3">Question</th><th>Expected Answer(s)</th><th>Max Mark</th><th>Additional Guidance</th></tr>
<tr><td>11.</td><td>(c)</td><td>(i)</td><td>$F = \overline{\left(A.\overline{B} + B.\overline{C}\right) + \left(\overline{A.B.C}\right)}$</td><td>3</td><td></td></tr>
<tr><td>11.</td><td>(c)</td><td>(ii)</td><td>see below.</td><td>4</td><td></td></tr>
<tr><td>11.</td><td>(c)</td><td>(iii)</td><td>AND gate</td><td>1</td><td></td></tr>
<tr><td>11.</td><td>(c)</td><td>(iv)</td><td>
<table>
<tr><th colspan="3">INPUTS</th><th colspan="5">GATE OUTPUT</th><th>(iv)</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>$A.\overline{B}$
1</th><th>$B.\overline{C}$
2</th><th>1+2
3</th><th>$\overline{A.B.C}$
4</th><th>$\overline{3+4}$
F</th><th>Fault condition</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
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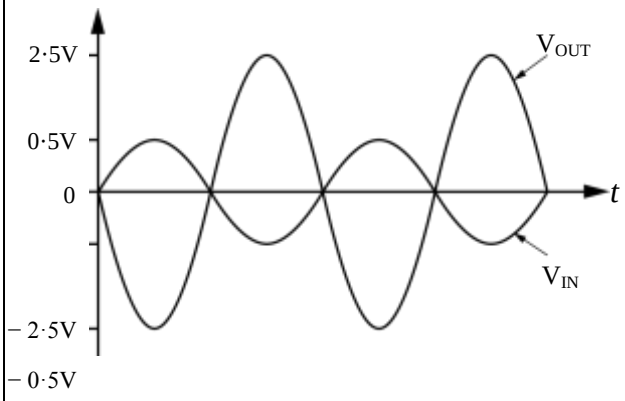
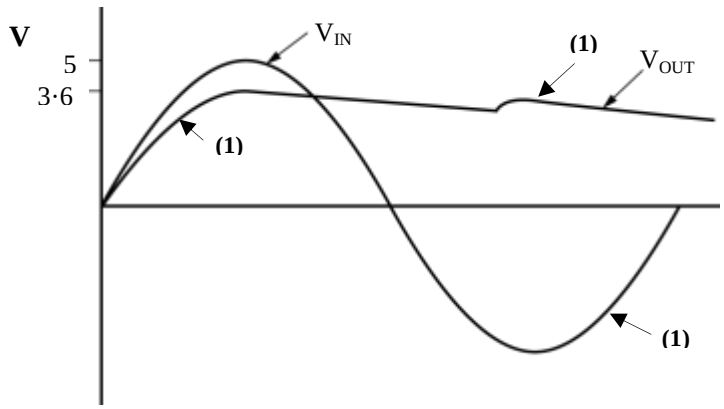
</table>
</td><td>5</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>(25)</td><td></td></tr>
</table>

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	**(a)**	**(i)**	Inverting amplifier	**1**	
12.	**(a)**	**(ii)**	$\text{Gain} = \frac{10\text{k}\Omega}{2\text{k}\Omega} = 5$ V_{OUT} pk–pk = 5 × 1 = 5V pk–pk	**3**	
12.	**(a)**	**(iii)**	V_{OUT} rms = 0·707Vpk = 0·707V × 2·5 = 1·77V	**2**	
12.	**(a)**	**(iv)**		**3**	
12.	**(b)**	**(i)**	Full-wave Rectification.	**1**	
12.	**(b)**	**(ii)**	D1 and D3.	**2**	
12.	**(b)**	**(iii)**	As the capacitor is charged it maintains a higher voltage across R_L when the input voltage is falling thereby allowing a 'smoother' outout voltage.	**3**	
12.	**(b)**	**(iv)**		**3**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	**(c)**	**(i)**	Common Source FET amplifier (1 mark for amplifier alone)	**2**	
12.	**(c)**	**(ii)**	1 – Gate, 2 – Drain 3 – Source	**3**	
12.	**(c)**	**(iii)**	Gain = 16/0·5 = 32	**2**	
				(25)	

[END OF MARKING INSTRUCTIONS]