2015 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)**		145_{10}	**2**	
1.	**(b)**		BA_{16}	**2**	
1.	**(c)**		10101110_2	**2** **(6)**	
2.	**(a)**		1 = base, 2 = collector, 3 = emitter	**3**	
2.	**(b)**		1 = gate, 2 = drain, 3 = source	**3** **(6)**	
3.	**(a)**		Half-wave rectifier	**2**	
3.	**(b)**		Full-wave rectifier	**2** **(4)**	
4.	**(a)**		Common Source Amplifier or FET Amplifier.	**1**	
4.	**(b)**		Gain = V_{OUT}/V_{IN} = 12/0·4 = 30	**2** **(3)**	
5.	**(a)**		Upwards	**1**	
5.	**(b)**		I = F/BI = 1·6/(0·2 × 0·4) = 2A	**2** **(3)**	
6.	**(a)**		180º phase shift	**1**	
6.	**(b)**		$V_{OUT} = V_{IN} \times Rf/Ri$ = 0·4 × 5 = 2V	**2**	
6.	**(c)**		Required gain = 10 hence max Ri will be when Rv = 50kΩ hence Ri = 5kΩ	**3** **(6)**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answer(s)</th><th>Max Mark</th><th>Additional Guidance</th></tr>
<tr><td>7.</td><td>(a)</td><td></td><td>$Z = \left(A + \overline{B} + C\right).\left(\overline{\overline{A} + B + C}\right)$</td><td>2</td><td></td></tr>
<tr><td>7.</td><td>(b)</td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>1</td><td></td><td>2</td><td>1·2</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>$A + \overline{B} + C$</td><td>$\overline{A} + B + C$</td><td>$\overline{\overline{A} + B + C}$</td><td>Z</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
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<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table>
</td><td>4</td><td></td></tr>
<tr><td>7.</td><td>(c)</td><td></td><td>$Z = A.\overline{B}.\overline{C}$</td><td>2

(8)</td><td></td></tr>
<tr><td>8.</td><td>(a)</td><td></td><td>R_t = 2 + 12//4 = 5Ω</td><td>2</td><td></td></tr>
<tr><td>8.</td><td>(b)</td><td></td><td>I_s = 10/5 = 2A</td><td>1</td><td></td></tr>
<tr><td>8.</td><td>(c)</td><td></td><td>$V_{12\Omega}$ = 2 × 3 = 6V
$I_{12\Omega}$ = 6/12 = 0·5A</td><td>3</td><td></td></tr>
<tr><td>8.</td><td>(d)</td><td></td><td>P = VI 10 × 2 = 20W</td><td>1</td><td></td></tr>
<tr><td>8.</td><td>(e)</td><td></td><td>E = Pt = 20 × 10 × 60 = 12kJ</td><td>1

(8)</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Expected Answer(s)</th><th>Max Mark</th><th>Additional Guidance</th></tr>
<tr><td>9.</td><td>(a)</td><td></td><td>Opening conditions

Opening time A = 1
Keypad B = 1
Swipe Card C = 0

$F = A.\overline{B}.\overline{C} + A.B.C$</td><td>2</td><td></td></tr>
<tr><td>9.</td><td>(b)</td><td></td><td>
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Z</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td></tr>
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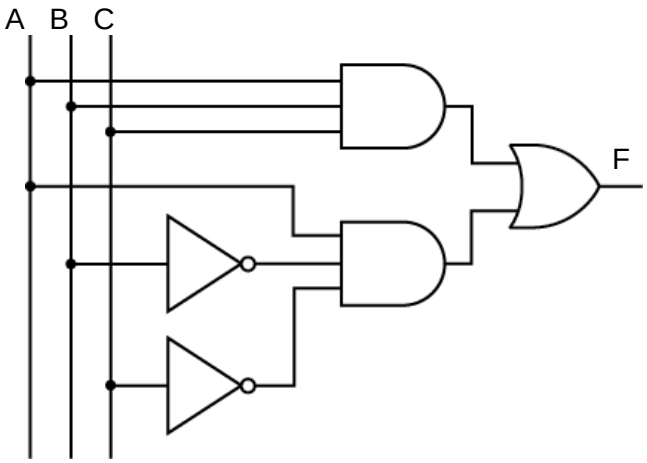
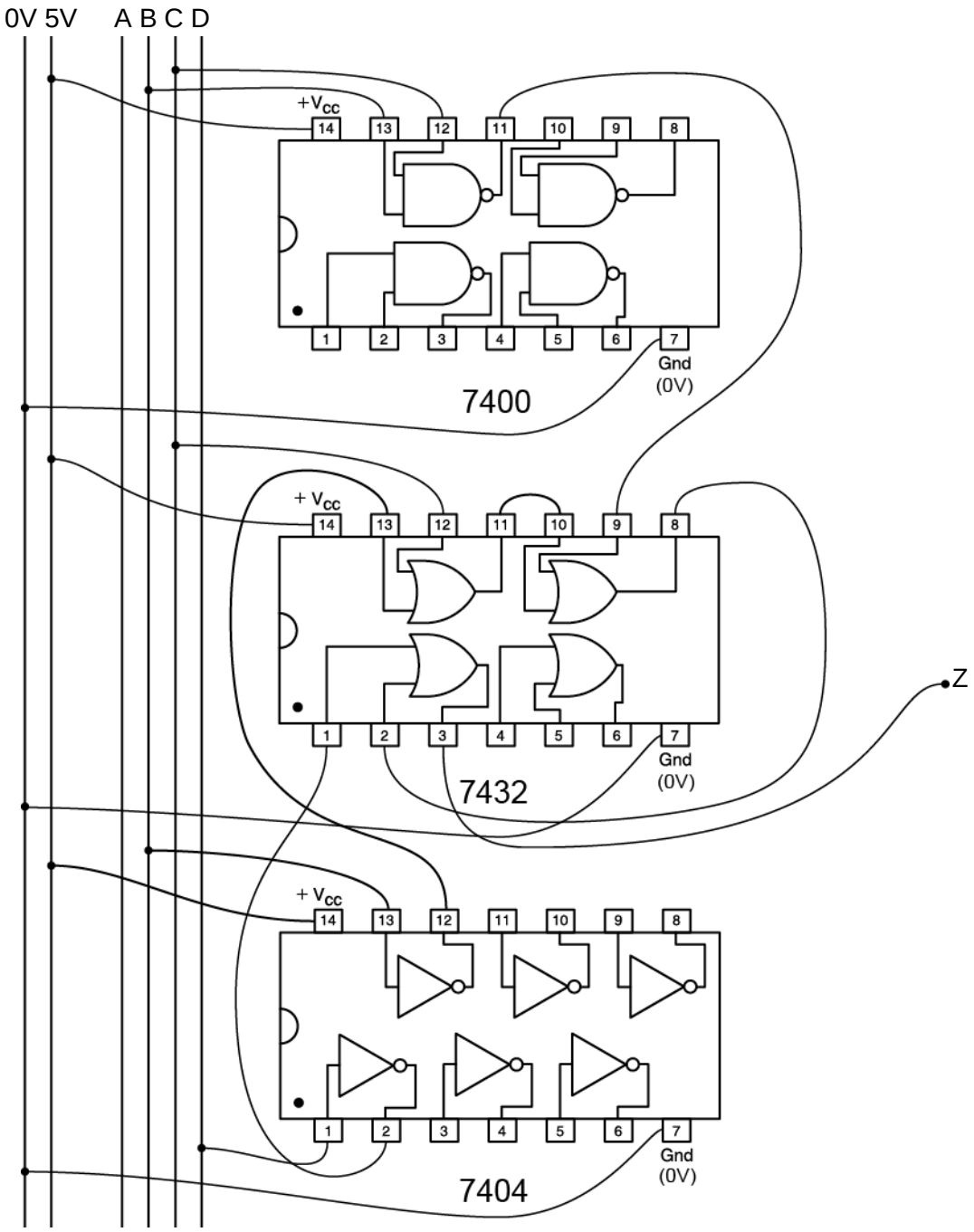
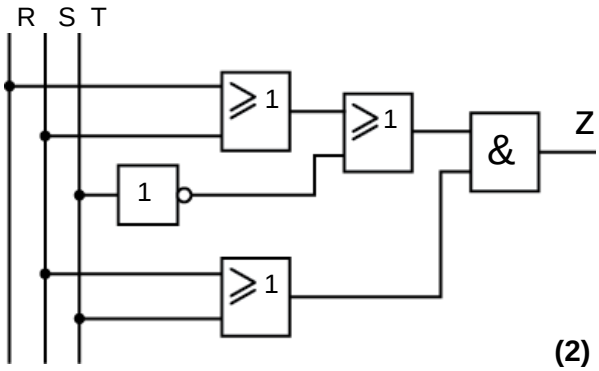
</td><td>2</td><td></td></tr>
<tr><td>9.</td><td>(c)</td><td></td><td> 
</td><td>2

(6)</td><td></td></tr>
</table>

Section B

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	**(a)**	**(i)**	0111_2	**2**	
10.	**(a)**	**(ii)**	1000_2	**2**	
10.	**(b)**		$Z = \overline{A.B.C}$	**3**	
10.	**(c)**		one possible solution  	**6**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	**(d)**		 **(2)** Three input solutions is also acceptable. | A	B	C	$R+S+\overline{T}$	S + T	**Z**
0	0	0	1	0	**0**
0	0	1	0	1	**0**
0	1	0	1	1	**1**
0	1	1	1	1	**1**
1	0	0	1	0	**0**
1	0	1	1	1	**1**
1	1	0	1	1	**1**
1	1	1	1	1	**1**	 **(4)**	**6**	
10.	**(e)**			**6**	

			TP1	TP2	1+2	**TP1**	**TP2**	
A	B		(A.B).(A.C)	B.C		0	0	**FAULT**
0	0	0	0	0	0	0	0	**0**
0	0	1	0	0	0	0	0	**0**
0	1	0	0	0	0	0	0	**0**
0	1	1	0	1	1	0	1	**1**
1	0	0	0	0	0	0	0	**0**
1	0	1	1	0	1	0	0	**0**
1	1	0	1	0	1	0	0	**0**
1	1	1	1	1	1	0	1	**0**

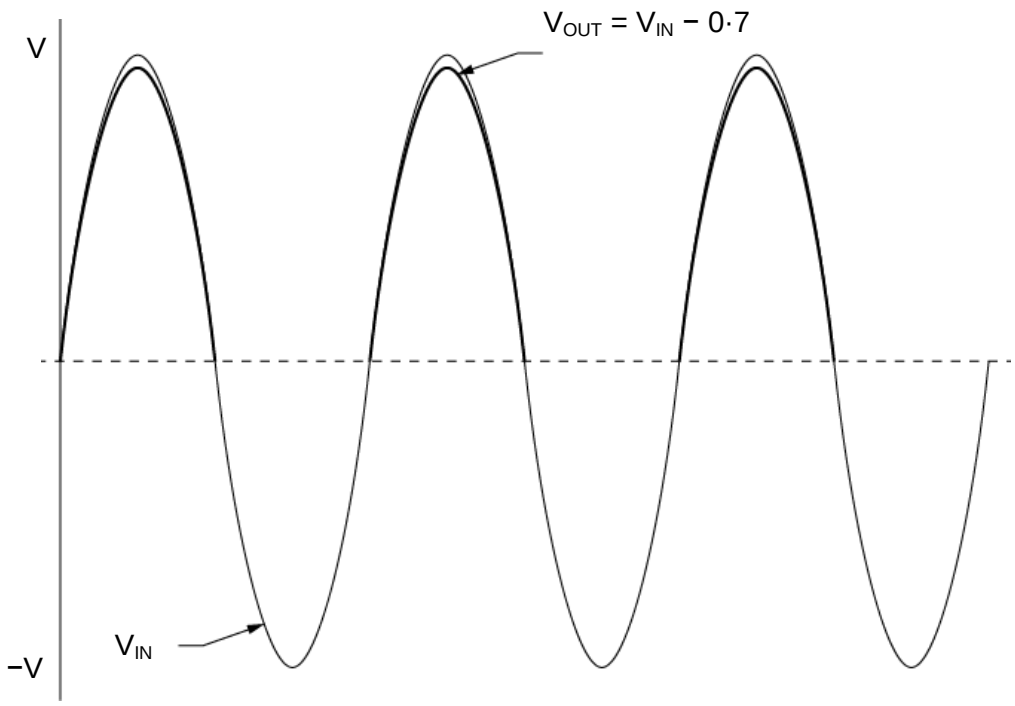
Marks awarded for construction/derivation of truth table and identifying the location of the faulty output **(4)**

Fault occurs when input A, B and C are on and the output of gate 4 is low. As this does not happen when B and C are on there is no problem at TP2 then the output of gate 1+2 or the input to gate 4 may be held low **(2)**

(25)

Question			Expected Answer(s)	Max Mark	Additional Guidance
11.	**(a)**	**(i)**	40V	**1**	
11.	**(a)**	**(ii)**	$40 \times 0{\cdot}707 =$ **28·28V**	**2**	
11.	**(a)**	**(iii)**	1·2ms	**1**	
11.	**(b)**	**(i)**	$E = B \times 1\ v = 2{\cdot}25 \times 10^{-3} \times 2{\cdot}5 \times 10 =$ **6·25mV**	**2**	
11.	**(b)**	**(ii)**	$F = B \times 1 \times I$ hence $I = F / (B \times 1)$ $I = 0{\cdot}4 / (1{\cdot}2 \times 10^{-3} \times 2{\cdot}5) =$ **133·33A**	**3**	
11.	**(c)**	**(i)**	$V_S = V_{R1} + V_{R4} + V_{R5}\ V_{R7}$ $V_{R1} = I_5 \times (R_1//R_2) = 3 \times (20 \times 20)/20 + 20 = 3 \times 10 =$ **30V** $V_{R4} = V_{R3} I_3 \times R_3 = (I_5 - I_4) \times 2 = (3 - 1) \times 2 =$ **4V** $V_{R5} = I_5 \times R_5 = 3 \times 10 =$ **30V** $V_{R7} = I_7 \times R_7 = 3 \times 15 =$ **45V** $V_S = 30 + 4 + 30 + 45 =$ **109V**	**5**	
11.	**(c)**	**(ii)**	$I_T = I_{R6} + I_{R5} = 5 + 3 = 8A$ $R_T\ V_S/I_T = 109/8 =$ **13·625Ω**	**2**	
11.	**(c)**	**(iii)**	$R_4 = V_{R3}/I_{R4} = 4/1 =$ **4Ω** or by current division	**1**	
11.	**(c)**	**(iv)**	$V_{R6} = V_S =$ **109V**	**1**	
11.	**(c)**	**(v)**	$R_6\ V_{R6}/I_{R6} = 109/5 =$ **21·8Ω**	**2**	
11.	**(d)**	**(i)**	$I_{R2} = I_S - I_{R3} = 8 - 2 = 6A$ $P = I^2 \times R = 6 \times 6 \times 10 =$ **360W**	**2**	
11.	**(d)**	**(ii)**	$P_T = V_S \times I_S = 180 \times 8 =$ **1440W**	**1**	
11.	**(d)**	**(iii)**	$E = P \times T = 1440 \times 24 \times 60 \times 60$ = **124416000J = 124·416MJ**	**2** **(25)**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	**(a)**		Common Emitter Amplifier **(1)** **C_1** :- Coupling Capacitor **(1)** **C_2** :- Coupling Capacitor **(1)** **C_3** :- Decoupling Capacitor or Bypass Capacitor **(1)**	**4**	
12.	**(b)**	**(i)**	By Kirchoffs $V_{R3} = V_S - V_{out} = 12 - 6 = 6V$ $I_{R3} = V_{R3}/R_3 = 6/1500 =$ **4mA**	**2**	
12.	**(b)**	**(ii)**	$G = 400 = I_c/I_b$ hence $I_b = I_c/G = 4mA/400 =$ **10µA**	**2**	
12.	**(b)**	**(iii)**	$I_{R2} = V_{R2}/R_2 = 1{\cdot}4/6800 =$ **206µA**	**2**	
12.	**(b)**	**(iv)**	$I_{R1} = I_{R2} + I_b = 206 + 10 = 216Ma$ $V_{R1} = V_S - V_{R2} = 12 - 1{\cdot}4 = 10{\cdot}6V$ Hence $R_1 = V_{R1}/I_{R1} = 10{\cdot}6/216Ma =$ **49·074kΩ**	**3**	
12.	**(c)**	**(i)**	Non inverting Op Amp	**1**	
12.	**(c)**	**(ii)**	Gain = $(R_2/R_1) + 1 = (50/10) + 1 = 5 + 1 = 6$ Gain = V_{OUT}/V_{IN} hence $V_{IN} = V_{OUT}$/gain = 550mV/6 = 91·66mV	**4**	
12.	**(c)**	**(iii)**	a) By adjusting the variable resistor Rv **(1)** b) Offset Null adjustment **(2)**	**3**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	(d)	(i)		2	
12.	(d)	(ii)		2	
				(25)	

[END OF MARKING INSTRUCTIONS]