



**ADVANCED GCE
ELECTRONICS**
Control Circuits

2530

INSERT

**Tuesday 8 June 2010
Morning**

Duration: 1 hour 15 minutes



INSTRUCTIONS TO CANDIDATES

- This insert giving details of the instruction set of a microprocessor is to be used for question 7.

INFORMATION FOR CANDIDATES

- This document consists of **2** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

- Do not send this Insert for marking; it should be retained in the centre or destroyed.

Notes on the Instruction Set of a Microprocessor

The microprocessor has the following registers

Program counter	(8 bit)	PC
Accumulator	(8 bit)	A
Index Register	(8 bit)	X

$M(n)$ represents the contents of memory whose address is the value of the byte n .

$M(X)$ represents the contents of memory whose address is stored in the index register.

$M(FF)$ is an eight bit output port; $M(EF)$ is an eight bit input port.

INSTRUCTION		FUNCTION
3E	n	$A \leftarrow n$
C6	n	$A \leftarrow A + n$
D6	n	$A \leftarrow A - n$
E6	n	$A \leftarrow A \text{ AND } n$ (i.e. $A \leftarrow A.n$)
EE	n	$A \leftarrow A \text{ EOR } n$ (i.e. $A \leftarrow A \oplus n$)
3A	n	$A \leftarrow M(n)$
32	n	$M(n) \leftarrow A$
7E		$A \leftarrow M(X)$
77		$M(X) \leftarrow A$
86		$A \leftarrow A + M(X)$
96		$A \leftarrow A - M(X)$
A6		$A \leftarrow A \text{ AND } M(X)$
AE		$A \leftarrow A \text{ EOR } M(X)$
6F		$X \leftarrow A$
7D		$A \leftarrow X$
C9		$X \leftarrow X + 1$
C3	n	$PC \leftarrow n$
CA	n	$PC \leftarrow n$ if $A = 0$, otherwise continue
C2	n	$PC \leftarrow n$ if $A \neq 0$, otherwise continue
00		No operation
76		Halt

The first instruction fetched by the microprocessor after a reset will be the one held in the memory location whose address is 00.



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