

Code: AE27

Subject: DIGITAL HARDWARE DESIGN

AMIETE – ET (OLD SCHEME)

Time: 3 Hours

OCTOBER 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. Which is not a property of VHDL
- (A) Parallel language
(B) Strongly typed language
(C) Uses Implicit default sequential control flow
(D) Uses explicit time delays
- b. Component instantiation is use in _____ modeling
- (A) Structural (B) Behavioral
(C) Data flow (D) High level model
- c. The signal assignment statement is denoted by the symbol
- (A) '=' (B) '='
(C) '>=' (D) '<='
- d. Pattern recognizer can be implemented using _____
- (A) Decoder (B) Counter
(C) Mux/De-mux (D) Shift register
- e. Operators belong to _____ of data subsystem.
- (A) Functional module (B) Data paths
(C) Storage module (D) Conditional points
- f. _____ has no AND gates.
- (A) Coincident Decoder (B) Tree Decoder
(C) Priority encoder (D) Binary encoder

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- g. PLA is a combinational module that provides _____
- (A) NOT-AND-XNOR (B) NOT-AND-OR
(C) NOT-AND-NOR (D) NOT-AND-XOR
- h. In tabular representation of switching functions, an integer j is associated with each n -tuple. For n -tuple j is defined as
- (A) $j = \sum_{i=0}^{n-1} x_i 2^{i+1}$ (B) $j = \sum_{i=0}^n x_i 2^i$
(C) $j = \sum_{i=0}^{n-1} x_i 2^i$ (D) $j = \sum_{i=0}^{n-1} x_i 2^{i-1}$
- i. Microcontroller design can be represented using
- (A) state machine (B) activity chart
(C) flow chart (D) micro machine
- j. A data path is said to be _____ if it connects a unique source and destination.
- (A) Indirected (B) Directed
(C) Erected (D) Dedicated

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. Explain data representation and coding in digital systems. Give an example for each. (6)
- b. Design a BCD-to-Excess-3 code converter using basic gates. (5)
- c. Explain the features of Computer Aided Design tools in digital systems. (5)
- Q.3** a. Use Boolean algebra to prove the following:
 $a'b' + ab + a'b = a' + b$ (5)
- b. Mention limitations of two-level networks in combinational systems. (5)
- c. Write short notes for the following:
(i) Serial Binary Adder.
(ii) Threshold switching function. (6)
- Q.4** a. Write a program in VHDL to implement the following ALU operations:
(i) Add (ii) Subtract
(iii) Multiply (iv) Divide (6)

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- b. Explain the behavioral and structural modeling in VHDL. (5)
- c. Explain delta delay and transport delay in VHDL. (5)
- Q.5** a. Explain the role of multiplexer as a Universal Combinational Module. (5)
- b. Give the representation of n-bit register and mention its applications. Label data and control signals in a *n-bit* register. (6)
- c. Compare PAL and GAL devices. (5)
- Q.6** a. Explain hazards and race in asynchronous sequential machines. Give an illustration. (7)
- b. Design a two input, two output sequence detector to detect a sequence 0101. (6)
- c. Mention the features of flow table reduction in asynchronous sequential machines. (3)
- Q.7** a. Design data subsystem for displaying values from 1 to 10. Draw the relevant block diagram with data and control signals. (7)
- b. Compare the features of microprogrammed controller with respect to controller implemented on a fixed network. (5)
- c. Give an example to illustrate horizontal and vertical encoding in control fields of microinstruction. (4)
- Q.8** a. Determine the minimal state table that is equivalent to the following: (5)

PS	Input	
	$x = 0$	$x = 1$
<i>a</i>	<i>f, 0</i>	<i>b, 0</i>
<i>b</i>	<i>d, 0</i>	<i>c, 0</i>
<i>c</i>	<i>f, 0</i>	<i>e, 0</i>
<i>d</i>	<i>g, 1</i>	<i>a, 0</i>
<i>e</i>	<i>d, 0</i>	<i>c, 0</i>
<i>f</i>	<i>f, 1</i>	<i>b, 1</i>
<i>g</i>	<i>g, 0</i>	<i>h, 1</i>
<i>h</i>	<i>g, 1</i>	<i>a, 0</i>

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- b. Explain the working of asynchronous sequential machine and give its representation. (6)
- c. Explain the role of functional decomposition in combinational systems. (5)

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Q.9 a. Write short notes from any **THREE** of the following:

- (i) Microprogrammed Controller
- (ii) Storage modules of a Data subsystem
- (iii) Process statement in VHDL
- (iv) Programmable Sequential Arrays

(3×4 = 12)

b. Give an example to illustrate multiple output switching function and their minimization. **(4)**