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PRESIDENCY UNIVERSITY BENGALURU

**SET-B**

SCHOOL OF ENGINEERING

**END TERM EXAMINATION – MAY/JUNE 2024**

**Semester :** Semester VI - 2021

**Course Code :** ECE3048

**Course Name :** FPGA Design for Embedded Systems

**Program :** B.Tech. Electronics and Communication Engineering

**Date :** June 19, 2024

**Time :** 1:00 PM - 4:00 PM

**Max Marks :** 100

**Weightage :** 50%

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

**PARTA**

**ANSWER ANY FIVE QUESTIONS (5 Q X 3 M = 15 M)**

* 1. Soft core processors are more useful in terms of implementation and verification. What are the various advantages the soft processor has list them in detail.

(CO1) [Knowledge]

* 1. FPGA 's CLB consist of LUTs and Internally, LUTs comprise 1-bit memory cells (programmable to hold either ‘0’ or ‘1’) and a set of multiplexers. For a 2 input LUTS explain with diagram how many bits it can store and what is the size of the multiplexer it can have.

(CO1) [Knowledge]

* 1. Embedded systems are programmed using embedded programming. Define embedded systems. With the help of system level architecture explain the embedded systems. List the various operating systems available for specific applications such as agriculture and medical applications.

(CO1) [Knowledge]

* 1. In a competitive environment, chip development cycles are compressed, causing design teams to reuse [semiconductor](https://www.perforce.com/solutions/semiconductor) IP cores to accelerate time to market. List the types of Ip cores available and classify them correctly.

(CO2) [Knowledge]

* 1. Quartus prime tool is used for designing and synthesizing the HDL code for various FPGA devices. If you have been asked to design a half adder using a schematic way. List the steps you will follow to generate the output.

(CO2) [Knowledge]

* 1. Model SIM is used for functional simulation along with Quartus prime, List the procedure after compilation to view the output of functional simulation within Model SIM assuming an adder circuit.

(CO2) [Knowledge]

* 1. The first programmable logic device was developed in 1956 and commercially made available during 197 Name the logic device and draw a structure.

(CO3) [Knowledge]

**PART B**

**ANSWER ANY THREE QUESTIONS (3 Q X 15 M = 45 M)**

* 1. A lookup table (LUT) is defined as characteristic feature of an FPGA. It stores a predefined list of logic outputs for any combination of inputs. Suppose we want to realize a Boolean Function of four input variables A, B, C, and D using a 4-input LUT. Here, let the output become high only when any of the two input variables are one.
     1. Define lut and its basic structure [6]
     2. Design a truth table for the same.[2]
     3. Show how the values will be stored in LUT [2]

Now, if ABCD = 1010, then show the output of the LUT, Y, will take what value from the memory

cell and makes its way to the output [5]

(CO1) [Comprehension]

* 1. Hardware description language plays a role in deciding the target FPGA device for design.
     1. List various styles of modeling as per the hierarchy available in Y chart of the modeling.[5]
     2. Write a HDL code for half adder using verilog in all the available styles.[10]

(CO2) [Comprehension]

* 1. Hardware description language is used to design and programme FPGA for specific design.
     1. List the two popular HDL languages for programming FPGA?[2]
     2. List the difference between these HDL languages?[4]
     3. List the popular software which allows HDL coding?[3]
     4. Using structural style of programming to write a HDL code for 4:1 multiplexer that can be implemented on FPGA?[6]

(CO3) [Comprehension]

* 1. 1. As an embedded designer you have come across many hardcore processors which you can program for any application. Due to the demand in embedded applications and their use in IoT application the softcore processor is also getting their popularity.
     1. List four soft core processor available in market? [4]
     2. List any six parameters to compare their performance?[6]
     3. List the features of Intel soft core processor?[5]

(CO4) [Comprehension]

**PART C**

**ANSWER ANY FOUR QUESTIONS (4 Q X 10 M = 40 M)**

* 1. The FPGA devices are part of Programable logic family. Explain with block diagram the basic classification of programmable logic devices. Also list the criteria that one can use for the selection of these devices.

(CO1) [Application]

* 1. 1. Hardware programmability is one of the big achievements in the field of hardware design. Programable memory has significantly contributed in the development of the programmable logic devices.
     1. Name the programmable device that consisting of a programmable “wired” AND-Programable OR-gates. [2]
     2. Implement the F1=A.B.C’+A’.B.C and F2=A’B’+A.B.C [8]

(CO2) [Application]

* 1. The FPGA dominates the programable logic world and most importantly, it also helps to develop fast solutions for the Embedded designs.

1. Discuss various types of types FPGAs [6]
2. List out all the components of FPGA [4]

(CO2) [Application]

* 1. On-chip memory is the simplest type of memory for use in an FPGA-based embedded system. The memory is implemented in the FPGA itself; consequently, no external connections are necessary on the circuit board.
     1. List advantages and disadvantages of on-chip memory [ 2]
     2. Explain four popular examples of on-chip memory [8]

(CO1) [Application]

* 1. Moden FPGA design is no longer cantered on HDL module design, as it is on acquisition and use of IP cores. List all the IP core offerings available, Also list the vendors available in the market .

(CO3) [Application]

* 1. 1. Efficient memory use increases the performance of FPGA-based embedded systems. Embedded systems use memories for a range of tasks, such as the storage of software code and lookup tables (LUTs) for hardware accelerators.
     1. Explain the on-chip memory.[2]
     2. Describe the Advantages and Disadvantages of on-chip memory.[4]
     3. Explain one application of on chip memory [2

(CO4) [Application]