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PRESIDENCY UNIVERSITY BENGALURU

**SET-A**

SCHOOL OF ENGINEERING

**MAKE UP EXAMINATION – JULY 2024**

**Semester : 7**

**Course Code :** ECE3048

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

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

**Date :** 18-07- 2024

**Time :** 9:30 AM - 12:30 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.

FPGA softcore processor and IP are used to speed up the manufacturing of the chip and help to bring a product faster for testing. What is the core in the processor and what are the processes used to split the core into two to work as a virtual core?

(CO1) [Knowledge]

**2.** FPGA key feature is CLB. Describe the components of CLB, How it can be used to store 2 bit data.

(CO1) [Knowledge]

## 3.

Verilog allows us to use three different styles of modeling behavioral, dataflow, and structural. Write a Verilog code for designing a full adder using structural style of modeling

(CO1) [Knowledge]

1. Keywords are the **r**eserved words in Verilog. We can use them to define language. List a minimum eight keywords

(CO2) [Knowledge]

1. Data types in Verilog inform the compiler whether to act as a transmission line (like a wire) or store data. Define the data types available in Verilog with examples?

(CO2) [Knowledge]

## 6.

CPLD, FPGA, and ASIC are the three programmable devices available for embedded designers. List the parameters that can be used to compare them to help the designer to reach a final decision which is more suitable for the design?

(CO2) [Knowledge]

1. If we need a little logic to implement, we will choose CPLD and for a complex function we will use FPGA. There are many markets player to provide the solution for the same. List four popular vendors who provide FPGA.

(CO3) [Knowledge]

## PART B

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

1. FPGA characteristic feature contains lookup table (LUT). A LUT stores a predefined list of logic outputs for any combination of inputs. Here there are four variables A, B, C, D and the available LUT size is 3 input LUT. The output becomes high only when any of the two input variables (A, B, C, D) are one. 1.Design a truth table for the same.[2]

2. Ideal case calculate and explain what size of LUT needed [1] 3.Show how the values will be stored in LUT [2]

4 Now, if ABCD = 0101, then show the output of the LUT, Y, will take what value from the memory

cell and makes its way to the output with sketch [10]

(CO1) [Comprehension]

1. Hardware description language is used to design and programme FPGA for specific design.
   1. What are the hardware description languages ?[2]
   2. List key words used in HDL [5]
   3. Define net and wire ?[2]
   4. Using structural style of programming to write a HDL code for 2:3 encoder that can be implemented on FPGA?[6]

(CO2) [Comprehension]

1. EDA tools helps to create VLSI design in reality and also make it easy job to handle the Timing constraints and RTL design. These tools need to follow a systematic design flow of to achieve the great design. If you are a VLSI designer and you have been asked to create a prototype of the device
   1. List various design modelling styles used in VLSI design?[3]
   2. Explain the VLSI design flow in detail to final implementation on FPGA?[12]

(CO3) [Comprehension]

## 11.Your system’s memory requirements depend heavily on the nature of the applications which you plan to run on the system. Memory performance and capacity requirements are small for simple, low-cost systems. In contrast, memory throughput can be the most critical requirement in a complex, high-performance system.

* 1. List general types of memories can be used in embedded systems.
  2. What kind of volatile and non-volatile memories can be used with embedded system.
  3. Explain in short, the on-chip memory.

(CO4) [Comprehension]

## PART C

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

1. To achieve market to window, three popular devices FPGA, ASIC, and CPLD are available. Company engineers have to make a tough choice among them to select for their final implementation,

Discus these 3 devices based on the following criteria.

1. Best use for,

2. Customization,

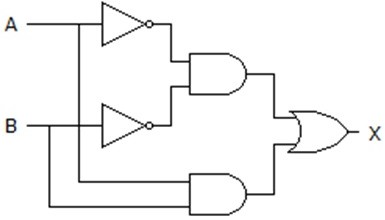
3. Performance, and development time and many more.

(CO1) [Application]

1. PLA and PAL are part of SPLD and also contribute in the development of CPLD family devises earlier generation. Implement the given Boolean equation using PAL and PLA. As per implementation give your comment on each one design=AB’+AC’B+B’C’

(CO2) [Application]

1. If you have been asked to design a half adder using Verilog a combinational circuit shown below. Which method you will select and also write Verilog code for the method .



(CO2) [Application]

1. 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]

(CO1) [Application]

1. The softcore processor is becoming popular among the designers.

Define role of FPGA in softcore processor design [2]. List characteristic of NIOS II softcore processor [8]

(CO3) [Application]

1. 1. Embedded processor are classified into two different class based on the data and instruction they access from the memory known as RISC and CISC processor?
   1. List the basic difference between RISC and CISC processor? [4]
   2. List various applications where they use embedded processors?[2]
   3. FPGA are becoming a first choice to implement the design, discuss the components and IP available in FPGA that makes it a better choice [2]

(CO4) [Application]