| 1. | Write VHDL code, simulate with test bench, synthesis, implement on PLD: Full adder by using half adder.   1. What are different characteristics of VHDL? Elaborate in detail.  * It allows better design management. * It allows detailed implementations. * It supports a multi-level abstraction. * It provides tight coupling to lower levels of design. * It supports all CAD tools. * It strongly supports code reusability and code sharing.  1. Differentiate between PLA and PAL devices.      1. Explain different types of VHDL modelling style.   **1. Data flow modeling (Design Equations):** Data flow modeling can be described based on the Boolean expression. It shows how the data flows from input to output. It works on Concurrent execution.  **2. Behavioral modeling (Explains Behaviour):** Behavioral modeling is used to execute statements sequentially. It shows that how the system performs according to the current statement. Behavioral modeling may contain Process statements, Sequential statements, Signal assignment statements, and wait statements.  **3. Structural modeling (Connection of sub modules):** Structural modeling is used to specify the functionality and structure of the circuit. Structural modeling contain signal declarations, component instances, and port maps in component instance. |
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| 2. | Write VHDL code, simulate with test bench, synthesis, implement on PLD: 4-bit ALU for Add, Subtract, AND, NAND, OR, XOR & XNOR.   1. What are different characteristics of VHDL? Elaborate in detail. 2. Differentiate between CPLD and FPGA devices.      1. What is difference between signal and variable in VHDL?   Variables can only be used inside processes, signals can be used inside or outside processes.  Any variable that is created in one process cannot be used in another process, signals can be used in multiple processes *though they can only be assigned in a single process*.  Variables need to be defined after the keyword *process* but before the keyword *begin*. Signals are defined in the architecture before the *begin* statement.  Variables are assigned using the **:=** assignment symbol. Signals are assigned using the **<=** assignment symbol. |
| 3. | Write VHDL code, simulate with test bench, synthesis, implement on PLD: Universal shift register with mode selection input for SISO, SIPO, PISO, & PIPO.   1. What do you mean by synthesis?   Synthesis is **a process where a VHDL is compiled and mapped into an implementation technology such as an FPGA or an ASIC**   1. What are different programming technologies used in PLDs? 2. Explain JTAG in detail.   JTAG (named after the Joint Test Action Group which codified it) is **an industry standard for verifying designs and testing printed circuit boards after manufacture**. JTAG implements standards for on-chip instrumentation in electronic design automation (EDA) as a complementary tool to digital simulation. |
| 4. | Write VHDL code, simulate with test bench, synthesis, implement on PLD: Mod - N Counter   1. What do you mean MOD-N counter? Calculate the number of F/F required for designing MOD-10 counter.   MOD Counters are **cascaded counter circuits that count to a predetermined modulus value before being reset**. A counter's job is to count by advancing its contents by one count with each clock pulse. Counters in a “count-up” mode advance their sequence of numbers or states when activated by a clock input   1. Differentiate between synchronous and asynchronous design.      1. Write VHDL statements for positive edge triggered clock and negative edge triggered clock. |
| 5. | Write VHDL code, simulate with test bench, synthesis, implement on PLD: LCD Interface   1. Explain how faster clock can be converted into slower clock using VHDL? 2. What are different control signals in LCD? 3. Differentiate between Mealy and Moore FSM. |
| 6. | Prepare CMOS layout in selected technology, simulate with & without capacitive load, comment on rise & fall times for Inverter.   1. Explain following.    1. Types of scaling 2. Nominal Scale. 3. Ordinal Scale. 4. Interval Scale. 5. Ratio Scale.    1. Inverter V-I Characteristics 6. The CMOS inverter’s steady-state power dissipation is negligible virtually, apart from small power dissipation because of leakage currents. 7. The VTC (voltage transfer characteristic) exhibits a complete o/p voltage swing in between 0 V & VDD, and the transition of voltage transfer characteristic is normally very sharp. Thus, the characteristics of the CMOS inverter look like an ideal inverter. 8. These inverters include high noise immunity, which lets them block both incoming & outgoing frequency spikes. 9. These are low-cost to produce mass    1. Parasitic in MOSFET   MOS Transistor parasitic capacitances are **formed due to the separation of mobile charges at various regions within the structure**. Parasitic Capacitances are the unwanted component in the circuit which are neglected while working in low-frequency. |
| 7. | Prepare CMOS layout in selected technology, simulate with & without capacitive load, comment on rise & fall times for NAND.   1. Explain following.    1. Static Power dissipation   The power dissipation **occurs in the form of leakage current when the system is not powered or is in standby mode**.   * 1. Dynamic Power dissipation   Dynamic power dissipation **occurs when the MOS transistor switches to charge and discharge the output load capacitance at a particular node at operating frequency**.   * 1. Strong ‘0’ and weak ‘1’ in NMOS   it can be concluded that **nmos can pass 0 strongly while it passes VDD weakly**. In contrast, pmos passes VDD strongly and 0 weakly. Thus if we consider logic 1 as VDD level and logic 0 as 0 voltage level, then it is better to have pmos passing logic 1 and nmos passing logic 0. |
| 8. | Prepare CMOS layout in selected technology, simulate with & without capacitive load, comment on rise & fall times for NOR gate.   1. Explain following 2. Noise margin   In communications system engineering, noise margin is **the ratio by which the signal exceeds the minimum acceptable amount**.   1. Hot electron effect   Hot carrier injection in MOSFETs **occurs when a carrier from Si channel is injected into the gate oxide**. For this transition, a carrier should have a high kinetic energy to reach the conduction or valence band in the oxide   1. Body Effect   Body effect **occurs when the body or substrate of the transistor is not biased at the same level as that of the source**. |
| 9. | Prepare CMOS layout in selected technology, simulate with & without capacitive load, comment on rise & fall times for 2:1 Mux using logic gates & transmission gates.   1. Implement 2:1 mux using    1. Conventional Logic    2. Transmission Gate |
| 10. | Prepare CMOS layout in selected technology, simulate with & without capacitive load, comment on rise & fall times for One bit SRAM Cell.  Q.1 Explain enhancement type MOSFET and depletion type MOSFET.  In most circuits, this means **pulling an enhancement-mode MOSFET's gate voltage towards its drain voltage turns it on**. In a depletion-mode MOSFET, the device is normally on at zero gate–source voltage. Such devices are used as load "resistors" in logic circuits  Q.2 Explain working of SRAM cell.   SRAM performs three operations which are Hold, Read and Write operations. Whenever the two access pass transistors of the word line (WL) are in OFF state, then the bit line and bit line bar (BL & BLB) are also in OFF condition, hence the memory cell is in hold state .If both the bit and bit bar lines act as inputs then write operation can be performed. If both the bit and bit bar lines act as outputs then the read operation can be performed. |
| 11. | | Write and execute a program for LED blinking using Arduino. What is sensor and actuator? Also draw interfacing Diagram of the same. | | --- | |
| 12. | Write a program for LED blinking using Raspberry-Pi. |
| 13. | Write and execute a program for IoT based DC motor Control with Arduino. What is DC motor? Also draw interfacing Diagram of the same. |
| 14. | What is sensor? Write and execute a program for temperature and humidity sensor using Arduino. |
| 15. | What is Bluetooth? Write and execute a program for Interfacing Arduino to Bluetooth Module. |
| 16. | What is sensor? Write and execute a program for temperature and humidity sensor using Arduino. |
| 17. | What is Actuator? Write and execute a program for giving a warning by buzzer using Arduino. Also draw interfacing Diagram of the same. |