

1514

Unique Paper Code : 2223510018
Name of the Paper : Digital Electronics
Name of the Course : B.Sc. Hons.-(Physics)_NEP: UGCF-2022
Semester : V-Semester
Duration : 3 hours
Maximum Marks : 90 Marks

Attempt **five** questions in all. Question No. 1 is compulsory. All questions carry equal marks.

Q. 1. Attempt any Six parts (all parts carry equal marks) (3×6 = 18)

- Convert 234_{10} into its binary and octal equivalents.
- Realize 2-input AND gate using diodes and resistors and explain its working.
- Subtract 43_{10} from 39_{10} using 2's complement method.
- What is an integrated Circuit (IC)? How can one differentiate between linear and digital IC?
- What do you understand by race condition and race around condition in SR and JK flip flop respectively?
- Write three main differences between synchronous and asynchronous counters.
- Draw the pin-out diagram of IC 555 timer. Why the control input pin (pin 5) is connected to ground via a capacitor if not used in the circuit?

Q. 2.

- Simplify the given expression using Boolean algebra

$$Y = \overline{A}BC + \overline{A}\overline{B}C + ABC + B\overline{C}D$$

Draw its truth table and design the equivalent NAND-NAND circuit.

- Determine the minimized Boolean expression for the function: $F(A,B,C,D) = \sum m(0,4,6,8,9,10) + d(1,2,11,7)$ using K-map method and design the logic circuit using basic gates.

Q. 3.

- a. Using the method of excitation table design the circuit of a T- flip flop using SR flip flop. Use block diagram of SR flip to draw the final circuit.
- b. Implement the circuit of a full adder using a 3:8 decoder and explain its working.

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Q. 4.

- a. Draw a circuit diagram of negative edge triggered JK flip-flop using NAND gates only. Give its truth table. Explain the race around condition and its consequences. Draw the output waveform for a given clock signal when both J and K inputs are high.
- b. Design an encoder circuit which encodes decimal number 0,1,2,3,4,5,6,7,8,9 into (0000), (1001), (1000), (0001), (0010), (0011), (0100), (0101), (0110), (0111) binary equivalents.

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Q. 5.

- a. Design a synchronous self-correcting MOD-7 count UP counter using the method of excitation table. Use positive edge triggered JK flip flop to design the counter. The initial state of the counter is 000.
- b. Design SIPO shift register and explain its working.

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Q. 6.

- a. Explain the working of astable multivibrator designed using IC-555 timer in terms of charging and discharging of timing capacitor. Define duty cycle and obtain the condition to produce rectangular wave with a duty cycle of 60%.
- b. Design an astable multivibrator using a 555-timer for an operating frequency of 2.5 kHz and duty cycle of 20%. Use $C = 1\mu\text{f}$.

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