INDRAPRASTHA INSTITUTE OF INFORMATION TECHNOLOGY DELHI
ECE 111 DIGITAL CIRCUIT
END SEMESTER EXAMINATION

Date: April 11, 2022 **Max. Marks: 100** **Time: 2:00PM to 4:00PM**

Note:

- **PLEASE READ THE INSTRUCTIONS CAREFULLY. ANY NON-ADHERENCE TO INSTRUCTIONS WILL BE CONSIDERED AS CHEATING.**
- **ANSWER ALL QUESTIONS. MARKS DISTRIBUTION IS GIVEN AFTER EACH QUESTION.**
- **No Mobile Phones will be permitted in the examination hall and WiFi should be turned off in your laptop**
- **It is an open book, open handwritten notes and lecture slides distributed to the class.**
- **You can use your laptop to read the books or class slides but can not turn on the 'class recordings', even with headphones.**
- **Borrowing of Text Books, open handwritten notes, lecture slides and Laptop strictly prohibited.**
- **You need to get the invigilator's permission to borrow pen, pencil, or eraser, failing to get the TA's permission will be treated as cheating.**
- **No photocopied notes prepared by another student will be permitted.**
- **The only person you are allowed to talk to is your invigilators.**
- **Any rough work should be done in the answer script and submitted. You are not permitted to take your rough work outside the examination hall.**
- **If you carry solutions to tutorials and practice problems in your handwriting it will be permitted. However, photocopies of these solutions, unless uploaded in the classroom, will not be permitted.**
- **Any rough work should be done in the answer script and submitted. You are not permitted to take your rough work outside the examination hall.**

Q1. Find an equivalent expression with only one occurrence of A and one occurrence of $\bar{A}$ (Shannon's expansion) at most for the expression F = $A{\cdot}B + \bar{A}\cdot C + (A + D)\cdot E + (\bar{A} + F)\cdot G$

[4 Marks]

Q2. An insurance company may issue Policy No. 22 only if the applicant

1. Has been issued Policy No. 19 and is a married male or
2. Has been issued Policy No. 19 and is married and under 25 or
3. Has not been issued Policy No. 19 and is a married female or
4. Is a male under 25 or
5. Is married and 25 or over.

Give a logic expression to describe the condition for the issuance of the premium.

[8 Marks]

Q3. Express $F = A \cdot (B + \bar{C}) + D$ as:

(a) Minimum sum of products.
(b) Minimum product of sums.
(c) Canonical sum of products.
(d) Canonical product of sums.

[8 Marks]

Q4. A sequential circuit is to have two inputs, x_1 and x_2, and one output, Z. The inputs represent, in binary, the numbers 0 to 3. If a change in input increases the represented number, the output is to turn on, if not already on. If a change in input decreases the represented number, the output is to turn off, if not already off. All input changes are possible except that both inputs will never change simultaneously. Draw the state diagram and then give the state transition table.

[16 Marks]

Q5. Design a counter to count in the sequence using TFFs, ensure that the counter does not get stuck in any illegal state.
The count sequence required is $001 \rightarrow 100 \rightarrow 010 \rightarrow 101 \rightarrow 110 \rightarrow 011 \rightarrow 001$,

[16 Marks]

Q6. The waveforms shown in Fig. Q.6(a) are applied to the circuit in Fig. Q.6(b); assuming initial value Q=0 plot the output.

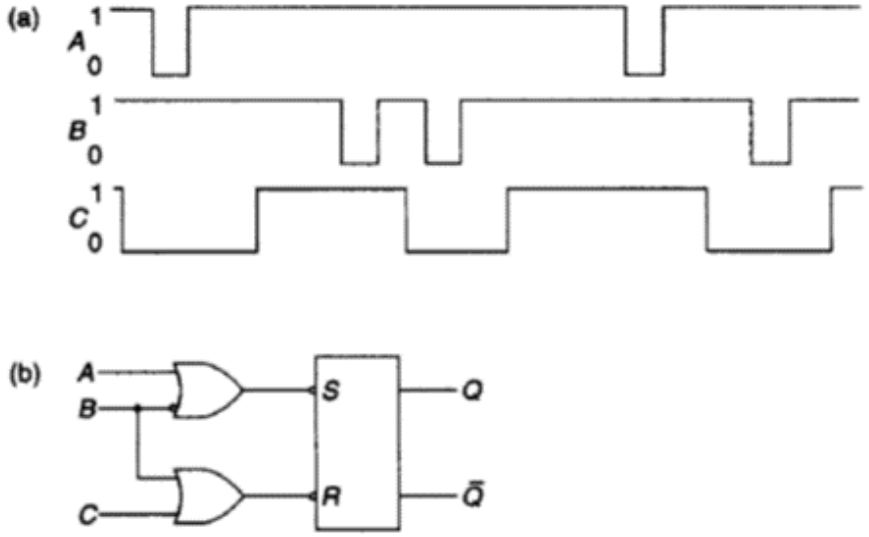

Fig. Q.6

[16 Marks]

Q7. Design a counter with minimum number of flip-flops to give an output sequence, a binary equivalent of first 8 prime numbers. 1 is not counted as a prime number. The first prime number is decimal number 2.

[16 Marks]

Q8. Consider the circuit in Fig. Q.8, which implements functions *f* and *g*. Redesign the circuit to implement the same functions, but with minimum number of 2-input gates. Assume that variable and its complement are available.

[16 Marks]

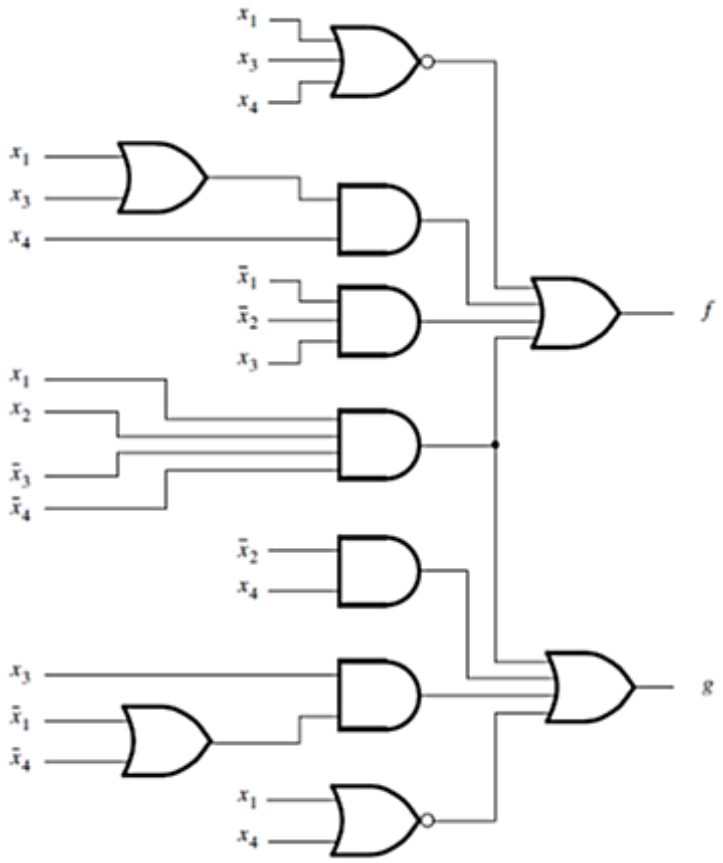

Fig. Q.8

BEST OF LUCK