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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES
B.Sc. (Information and Communication Technology) Degree
First Year Semester I Examination May / June 2016

ICT1303 – BASIC ELECTRONICS AND DIGITAL LOGIC DESIGN

Answer **any five (05)** questions   Time: **3 hours**

01   a.   **"In an intrinsic semiconductor, the number of holes is equal to the number of free electrons"**. Discuss the effect of adding an (trivalent or pentavalent) impurity to an intrinsic impurity.

(05 Marks)

b.   Discuss the operation of an ideal diode giving its transfer function. Discuss both forward and reverse biased operations.

(10 Marks)

c.   Explain the operation of this circuit drawing V_{AC} and V_{OUT}, and identify its operation.
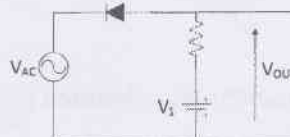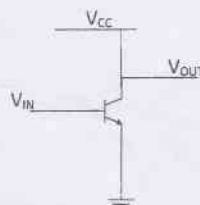

(05 Marks)

02   a.   Discuss the construction of a bipolar junction transistor giving necessary illustrations. Elaborate the effect of different levels of doping in different regions.

(10 Marks)

b.   **"An electronic circuit is desirable to have a very high input impedance and a very low output impedance"**. Discuss this statement.
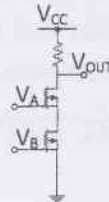
(05 Marks)

c.   Explain the operation of the given circuit when V_{IN} is 0 V and 3.5 V. Assume that VCC is 5V.

(05 Marks)

03   a.   **"Field-effect transistors are called *unipolar* transistors"**. Discuss why.

(05 Marks)

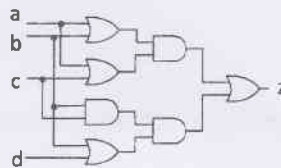b.   Explain the operation of the given circuit. Assume that both V_A and V_B are either 0 V or 5 V.

(05 Marks)

c.   Elaborate the differences between constructions of *enhancement* and *depletion* types of Metal Oxide Semiconductor Field Effect Transistors (MOSFETs).

(10 Marks)

04   a.   Write down the Boolean function of the given circuit.

(05 Marks)

b.   Simplify the function you obtained (in part **a**) above using a Karnaugh map.

(10 Marks)

c.   Draw the circuit diagram of the simplified circuit.

(05 Marks)

05   a.   Draw the logic implementations of an S-R flip-flop and a J-K flip-flop and discuss the differences in their behavior.

(05 Marks)

b.   Draw the circuit diagram of a J-K flip-flop and write down its characteristic table.

(05 Marks)

c. Explain the operation of the given sequential circuit using a timing diagram. Name the circuit considering its operation.
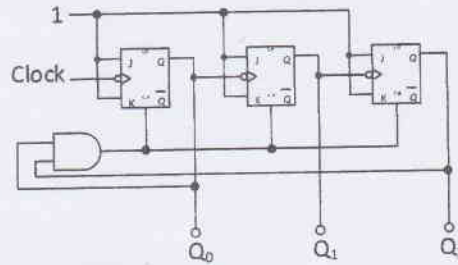
(10 Marks)

06 a. In Binary-Coded Decimal (BCD) representation, each decimal digit is encoded into a binary number separately. How many flip-flops are required to fabricate a divide-by-10 (MOD-10) BCD counter? Elaborate your answer using appropriate calculations.

(05 Marks)

a. Elaborate the difference between synchronous and asynchronous counters. You may use illustrations as appropriate.

(05 Marks)

c. Explain the steps involved in synchronous counter design using an appropriate example.

(10 Marks)

07 a. A grayscale counter counts numbers where two successive numbers differ only in one bit (e.g. 00 → 01 → 11 → 10 → 00). Design an asynchronous divide-by-12 (MOD-12) grayscale counter.

(20 Marks)

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