UNIVERSITY OF GHANA, LEGON
FIRST SEMESTER EXAMINATIONS, 2012/2013
LEVEL 200: BACHELOR OF SCIENCE IN ENGINEERING
CPEN 203 : DIGITAL CIRCUITS.

INSTRUCTIONS: *Answer any five (5) questions.*

TIME ALLOWED: *THREE (3) HOURS*

Q1. The Faculty of Engineering Sciences at the University of Ghana has four departments *A, B, C, D.* The facilities at the faculty are shared to the departments in proportion to the number of students in each department. The percentage of shares held by *A, B, C, D.* is 45%, 30%, 15%, 10% respectively. Any major decision at the faculty must have a minimum 60% of the total vote.

(a) Design a logic circuit to implement the voting in the faculty. [15marks]

(b) Implement the logic circuit in Q1 (a) using only NAND gates. [5marks]

Q2. (a) Clock pulses needed to control a digital circuit is being generated by astable multivibrator which has two NAND gates,a 20MΩ resistor and 100μF Capacitor.

(i)Draw the NAND gate digital clock circuit. [8marks]

(ii) Calculate the frequency of the clock pulse. [3marks]

(iii) State the function of the resistor in the clock circuit. [2marks]

(i)Explain the need for an additional RS Flip-Flop at the output of the clock circuit. [2marks]

(**b**) Explain the function of a digital Multiplexer circuit shown in figure1 [3marks]

(**c**)Write the Boolean expression for the 4-to-1 digital Multiplexer with data input **ABCD** and address select (control) lines **a** and **b** in figure 1 [2marks]

Examiner: Mr. Agyare Debra

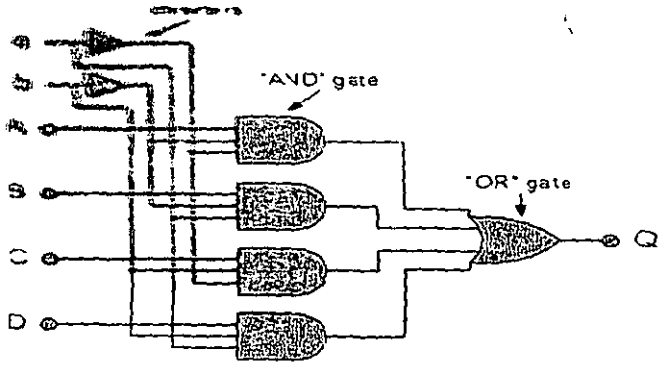

Figure 1

Q3. (a) Define the following digital ICs parameters:

(i) Speed of operation [2marks]

(ii) Noise immunity [2marks]

(iii) High level input voltage V_{IH} [2marks]

(b) Give two main advantages of CMOS ICs to TTL ICs. [2marks]

(c) Explain the operation of Three-state logic device and state one area of its application [6marks]

(d) A NAND gate has an input voltage Vcc equal to 5V. The input current is 2.5mA for high output and 3.2mA for low output. Find the power dissipated for 50%duty cycle. [6marks]

Q4.(a) Counters are classified as Synchronous and Asynchronous.Explain the difference between them. [2marks]

(b) A counter is required to count the number of milk bottles filled automatically in milk plant.A photocell and light source combination are used to generate a single pulse each time a bottle cross the path of this combination.If 2000 bottles are to be counted,find the minimum number of flip-flops required to construct the counter. [5marks]

(c) With the aid of a circuit diagram show how four flip-flops can be interconnected to reduce the normal 16 count to 10 count [8marks]

(d) Explain how the decade counter works [5marks]