EX/CHE/ET/T/313/2017 (OLD)

B. CHEM. 3RD YEAR 1ST. SEM. EXAM.-2017

ELEMENTARY ELECTRONICS

Time: Three hours Full Marks: 100

Answer ***five*** questions taking at least ***two*** from each part

PART-I

1. (a) Convert the following numbers

i) $(23)_{10} = (?)_8$ ii) $(6BE)_{16} = (?)_{10}$ iii) $(56.75)_{10} = (?)_2$ iv) $(5A.7D)_{16} = (?)_2$ [2x4]

(b) Perform the following subtraction separately using 1's and 2's complement methods

i) 1011 - 0101 ii) 11011 - 11001 [6]

(c) State and prove DeMorgan's theorems. [2+4]

2. (a) Simplify the expressions using Boolean postulates

(i) F1=$XY + XYZ + X\,(Y + XY)$ (ii) F2 = (A + B)(A + C)(B + C) [8]

(b) Simplify the following expression into SOP using Karnaugh map
F(A,B,C,D) = Σm(1,3,4,5,6,7,9,12,13) + d(0,15) . [7]

(c) Minimize the logic function Y(A,B,C,D) = m(0,1,2,3,5,7) using Karnaugh map. [5]

3. (a) What are advantages of digital circuits over analog circuits? Explain the term bit and byte. [4+2]

(b) Show the truth tables of all basic gates. [6]

(c) Design AND gate using NOR gates. [3]

(c) Design XOR gate using minimum number of NAND gates. [5]

4. (a) Write the differences between combinational and sequential logic circuit. [4]

(b) Explain the operation of J-K Flip-Flop using NAND gate only. [6]

(c) What is Race around condition in J-K flip-flop and how Master Slave combination helps to solve the problem? [10]

PART-II

5. (a)Define intrinsic and extrinsic semiconductor. Name two elemental and two binary semiconductors. How will you convert an intrinsic semiconductor to a n-type extrinsic semiconductor? What do you mean by compensated semiconductor? [4+2+2+2]

(b) Consider a silicon bar was doped by donor type having doping concentration of $N_D=10^{17}/cm^3$, then it is doped by acceptor type with doping concentration of $N_A=5x10^{17}/cm^3$. Determine the type of

semiconductor. Calculate the electron and hole concentration in the semiconductor. Given that the intrinsic carrier concentration is $1.5 \times 10^{10}/\ cm^3$ [4]

(c) In a p-type silicon sample, the hole concentration is $2.25 \times 10^{15}\ /cm^3$. If the intrinsic carrier concentration is $1.5 \times 10^{10}/\ cm^3$, calculate the electron concentration in the sample. [4]

(d) If an electric field is applied across a semiconductor, write the direction of the flow of electron and hole with respect to the direction of the applied electric field. [2]

6. (a) Draw and explain the current voltage characteristics of a pn junction diode. [6]

(b) Write differences between Avalanche and Zener breakdown associated with pn junction diode. [6]

(c) Define static and dynamic resistance associated with p-n junction diode. A p-n junction diode has a reverse saturation current of 1μA at 300 K. Calculate the static and dynamic resistances of the diode at 300 K for an applie bias of 0.3 V and - 0.3 V. Given that the value of thermal voltage at 300 K is 0.026 V. [3+5]

7. (a) Draw the circuit diagram of a bridge rectifier. Then with proper output waveform explain the operation of the rectifier circuit [4+6]

(b) For half wave rectifier calculate the dc output current, ripple factor and efficiency.[3+4+3]

8. (a) Write the purpose of biasing of a transistor. Define three stability factors of transistor biasing circuit. Draw the voltage divider bias circuit of common emitter BJT. Calculate the stability factor of the circuit with respect to reverse saturation current. [2+3+2+3]

(b) Write short notes on any two [5x2]

(i) JFET (ii) Clipper circuits (iii) zener diode