Motilal Nehru National Institute of Technology Allahabad
Department of Electronics and Communication Engineering
End Semester (odd) Examination 2016
Session: 2016 – 17
B. Tech. III Semester (ECE)
Principles of Electronics Engineering (EC-1301)

Time: 03hrs **Max. Marks: 60**

Instructions: Answer all the questions in sequence only and assume suitable data wherever necessary. All symbols and notations have their usual meaning.

1. (i) Implement the following functions using the don't-care conditions. Assume that both the normal and complement inputs are available.

(a) $F = A'B'C' + AB'D + A'B'CD'$ with no more than two NOR gates.
$d = ABC + AB'D'$

(b) $F = B'D + B'C + ABCD$ with NAND gates.
$d = A'BD + AB'C'D'$ [8]

(ii) (a) Find 16's complement of $(AF3B)_H$.
(b) Convert AF3B to binary.
(c) Find 2's complement of the result in (b).
(d) Convert the result of (c) to hexadecimal and compare with answer in (a). [4]

(iii) A Boolean function f of two variables x and y is defined as follows:
$f(0, 0) = f(0, 1) = f(1, 1) = 1$; $f(1, 0) = 0$.
Assuming complements of x and y are not available, implement the function f using minimum number of gates (use only 2-input NOR gates and 2-input OR gates). [3]

2. (i) Discuss the temperature dependence of V - I characteristics of a *pn* junction diode. [3]

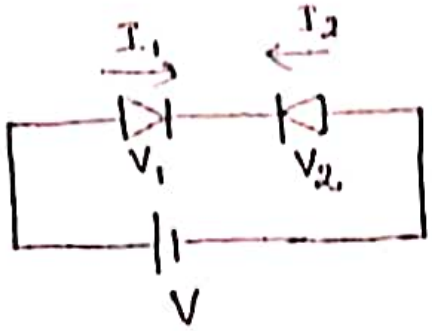
(ii) A 10 *V* zener diode is used to regulate the voltage across a variable load resistor. The input voltage varies between 13 *V* and 16 *V*, the load current varies between 10 *mA* and 85 *mA*. The minimum zener current is 15 *mA*. Calculate (a) Value of the series resistance (b) Power rating of the series resistance. [4]

(iii) Explain the working of a bridge rectifier with necessary circuit and waveforms. [4]

(iv) Two identical diodes are connected in series as shown below. Show that

$$\exp\left(\frac{qV_1}{kT}\right) + \exp\left(\frac{qV_2}{kT}\right) = 2$$

Calculate the voltage drop across each diode, assuming that the current through the reverse biased diode is I_0. [4]



3. (i) Draw a sketch to show the current components in a transistor and briefly explain the origin of each. Derive an expression of I_C in terms of I_B and I_{CBO}. Define α_{dc} and β_{dc}. [4]

(ii) Draw the input and output characteristics of a transistor connected in CE configuration. From these characteristics, how will you determine h-parameters? [3]

(iii) What is the need for biasing a transistor? What is meant by Q-point? Draw the collector-to-base bias circuit and derive an expression for the stability factor. [4]

(iv) If the various parameters of a CE amplifier which uses the self bias method are $V_{CC} = 12\ V$, $R_1 = 10\,k\Omega$, $R_2 = 5\,k\Omega$, $R_C = 1\,k\Omega$, $R_E = 2\,k\Omega$, and $\beta = 100$, find the coordinates of the operating point, assuming the transistor to be of silicon. [4]

4. (i) Explain the distinct regions of the output characteristics of a JFET. [4]

(ii) What is a MOSFET? How many types of MOSFETs are there? Briefly explain its working principle. [3]

(iii) What are the characteristics of an ideal Operational amplifier? Draw the schematic symbol of an Operational amplifier and list the different terminals with their functions. [4]

(iv) Discuss the applications of Operational amplifier as adder and subtractor. [4]