11.09.18 (2nd Half)

2018

EC-01, BASIC ELECTRONICS ODD SEMESTER SECTION: **E, F, G AND H**

Answer **ANY FIVE** Questions

411

Figures in right hand margin indicate marks

All parts of a question must be answered together

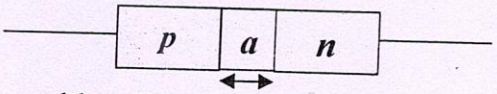
Time: **2Hours** Full Marks: **30**

1. (a) Describe the process of doping in semiconductors. What types of materials are preferred for that? Illustrate your answer with suitable figures. [4]
(b) Compute the number of electrons per unit volume in intrinsic Silicon at room temperature of 300K. [2]

2. (a) Discuss transport of carrier in semiconductors. [4]
(b) A uniform piece of Silicon of 0.2 μm long sustains a voltage of 1 V. The low field mobility is 1350 $cm^2/V.s$ and saturation velocity of carrier is 10^7 cm/s. Determine effective mobility. [2]

3. (a) Write down the expression for built in potential. How the built in potential change if the *p* type and *n* type semiconductors are heavily doped? [3]
(b) A Silicon pn junction employs $N_A=2\times10^{16}$ /cm^3 and $N_D=4\times10^{16}$ /cm^3 at 300K. Determine the built in potential. [3]

4. (a) A pn junction is illustrated in the figure below.



What is the region indicated by *a* known as? Describe the reasons for its existence. What changes will it undergo upon reverse bias and forward bias? Explain. [4]
(b) A Silicon pn junction employs $N_A=2\times10^{16}$ /cm^3 and $N_D=9\times10^{15}$ /cm^3 at 300K. Determine the capacitance per unit area at zero bias voltage. Given $\varepsilon_r^{Si}=11.7$. [2]

5. (a) Write down the expression for reverse saturation current and the total diode current.[1]
(b) Plot and explain the IV characteristics of a pn junction diode. From the plot, define static and dynamic resistance of the diode. [3]
(c) Explain Zener and Avalanche breakdown mechanism in pn junction diode. [2]

6. (a) Draw neat circuit diagram of a half wave and centre tap fullwave rectifier. [2]
(b) Determine the efficiency of a half wave and fullwave rectifier. Give a brief discussion on the obtained results. Comment on the PIV of diodes required for half wave and fullwave rectifiers. [4]

Some useful constants:
Electronic charge = **1.6×10^{-19}** Coulomb
Boltzmann constant: **$K_B=1.38\times10^{-23}$J/K**; Plank's constant **$h=6.626\times10^{-34}$ Js**;
For Silicon at 300 *K*: **μ_n = 1350 cm^2/V-s; μ_p = 480 cm^2/V-s; D_n=34 cm^2; D_p=12 cm^2**

10/1.

087

B.Tech IIIrd sem. Midsemester examination 2018-19
Subject: Networks and Transmission lines
Code: ECC301

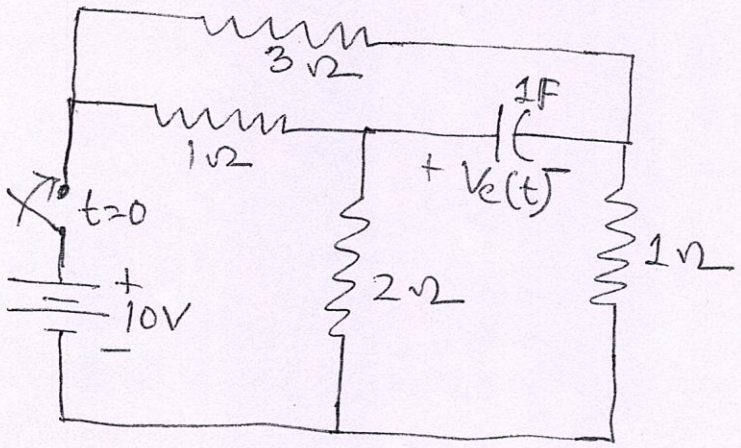
Full marks: 30

Attempt any three questions

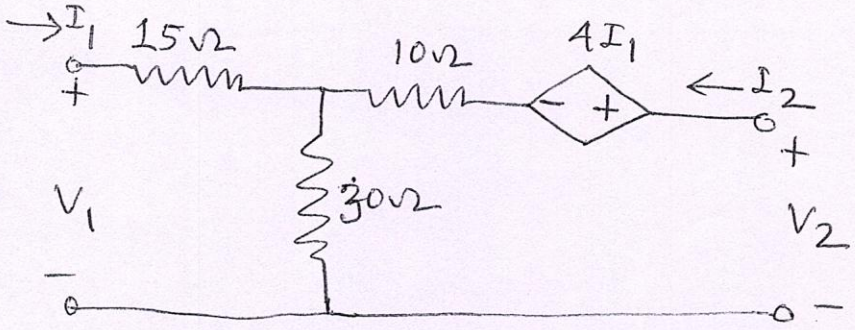
Q.1. Derive the expressions for characteristic impedance (Z_o) and propagation constant (γ) of a transmission line in terms of line parameters(R, L, G, C). (10)

Q.2. Derive the expression for voltage (E) and current (I) along a transmission line. (10)

Q.3. In the following circuit shown below, the switch is closed at time t=0, find $V_c(t)$ using Laplace transform: (10)



Q.4.Calculate the *z* parameters of the circuit shown below: (10)



086

Mid-term Question Paper

Subject: Electronic Devices and Circuits-I; Code: ECC 302

Session: 2018-19

Answer any six questions (Marks: 6x5=30)

Time: 2hrs

1. Calculate the reverse saturation current for a silicon P-N junction which passes a current of 15mA at 27° C when the forward bias voltage is 680mV.

2. A diode with 1 W maximum power dissipation at 25° C has a 4mW/ ° C derating factor. Calculate the maximum power that may be dissipated in the diode when its temperature is 80° C.

3. Determine the peak load voltage, Peak current, power dissipation in a 470 Ω load resistor connection to a bridge rectifier circuit that has a 24 V ac input. The rectifier diodes are germanium.

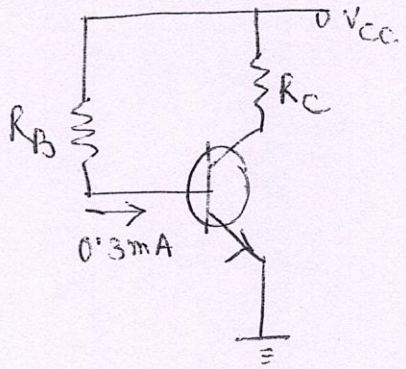
4. The current in a P-N junction diode is 0.5 mA at 340mV forward bias and 15 mA at 440mV forward bias. Determine the value of η. Assume V_T =25mV, Comment on the material used.

5. What should be the value of inductance to be used in an inductor filter connected a full wave rectifier operating at 400 Hz, if the ripple is not to exceed 5% for 100 Ω load.

6. A load of 1 K-ohm is connected across a 10 V Zener regulator. The Zener current can vary between 5mA and 55MA while maintaining the voltage constant. Find the minimum and maximum levels of the input voltage.

7. Derive the relations among α, β, γ in a transistor.

8. Determine the value of base resistor RB and stability factor for the fixed bias circuit shown in the following figure. Also determine the voltage between the collector and the ground. Given R_C=330Ω, β=100, V_{CC}=12V.



27.08.18
(R.KAR)

086

SIGNALS AND SYSTEMS
ECC 303

Full Marks = 30 Time = 2 Hours

Answer any **THREE**

Question No.1 (6+4 =10)

1. A trapezoidal pulse as defined by:

$$x(t) = \begin{cases} 5-t, & 4 \le t \le 5 \\ 1, & -4 \le t \le 4 \\ t+5, & -5 \le t \le -4 \\ 0, & \text{otherwise} \end{cases}$$

Determine the total energy of x(t). The above pulse is applied to a differentiator, giving output y(t). Determine the energy of the output signal y(t).

2. Give a sketch of the trapezoidal pulse x(10t -5).

Question No. 2 (6+4 =10)

1. Verify the equations given below:

$x(t)*h(t)=h(t)*x(t)$

$\{x(t)*h_1(t)\}*h_2(t) = x(t)*\{h_1(t)*h_2(t)\}$

$x(t-t_1)*h(t-t_2)= y(t-t_1-t_2)$ if $y(t)=x(t)*h(t)$

2. What do you understand by step response of the system? Evaluate the step response for the LTI systems represented by the following impulse responses:
   (i) $h[n] = (-1)^n [u(n+2) - u(n-3)]$
   (ii) $h(t)= e^{-|t|}$

Question No. 3(4+6=10)

1. The following are the impulse responses of certain LTI systems. Determine whether the systems are causal and/ or stable.
   (i) $h[n] = 5^n u[3-n]$
   (ii) $h(t) = e^{-6|t|}$

2. $x(t)= u(t-3)- u(t-5)$ and $h(t)= e^{-3t}u(t)$
   (i) Compute $y(t) = x(t) * h(t)$
   (ii) Compute $g(t) = \frac{dx(t)}{dt} * h(t)$.
   (iii) How is g(t) related to y(t)?

Question No. 4 (4+6 =10)

1. Give a complete solution for the system output y[n], where the system is being defined as: $y[n] + 2y[n-1]= x[n-1]$ with input $x[n]= e^{-n}u[n]$ and initial state being $y[-1]=0$.

2. Formulate the necessary pair of time and frequency representations for discrete time and continuous time periodic and aperiodic signals. In this context do verify the convergence issues wherever applicable.

081

Mid-term Question Paper

Subject: Analog Electronics; Code: ECC 331

Session: 2018-19

Answer any six questions (Marks: 6x5=30)

Time: 2hrs

1. A silicon P-N junction has a reverse saturation currents of 20nA at 25° C and 80nA at 25° C. Calculate the current at both temperatures when the forward bias voltage is 0.69 V.

2. A diode with 700mW maximum power dissipation at 25° C has 5mw/° C derating factor. If the forward voltage drop remains constant at 0.7 V, Calculate the maximum forward current at 25° C and at 65 ° C.

3. A half wave rectifier circuit has a 15 V ac input and 330Ω load resistance. Calculate the peak output voltage, the peak load current and the diode maximum reverse voltage.

4. What are the different types of clipping circuit and clapping circuits mostly used? Explain with suitable circuit diagrams and waveforms.

5. Define the Zener Breakdown and avalanche breakdown.

6. Explain the operating principle of LED. What are the types of materials used in LED? Why Si or Ge are not used for manufacturing LED? What is the applications of LED?

7. Derive the following parameters for full-wave bridge rectifier. V_{dc}, V_{rms}, P_{dc}, RF, PIV, η.

8. What should be the volue of inductance to be used in an inductor filter connected a full wave rectifier operating at 400 Hz, if the ripple is not to exceed 5% for 100 Ω load.