202451106

Indian Institute of Information Technology Vadodara

Mid Semester Examination (Autumn, 2024-25)

Course: EC100 Basic Electronic Circuits

Full Marks: 80

Date: 08/10/2024

Time: 9:30 PM - 11:30 AM

Instructions:

1. *Attempt **ALL** the questions. Each question carries equal marks.*
2. *Answer each question sequentially beginning on a new page.*
3. *Use of a scientific calculator is permitted.*

Q1. In the circuit shown in Fig.1, convert current sources to voltage sources and calculate the current I_L through the resistor $R_L = 3\Omega$.

Fig.1.

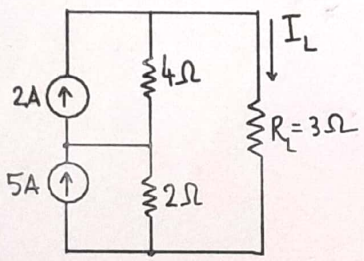


Fig.2.

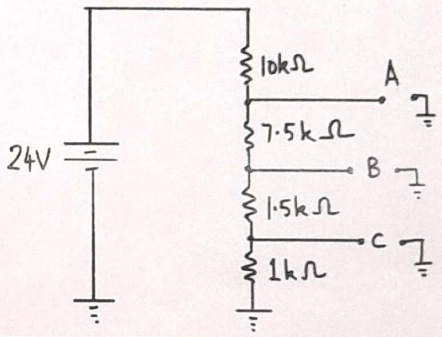


Fig.3

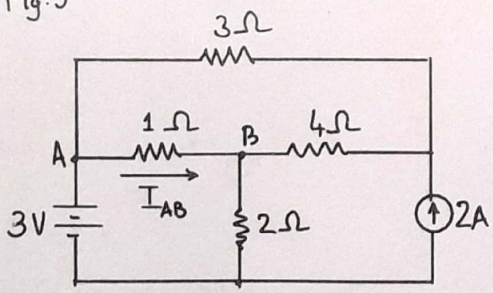
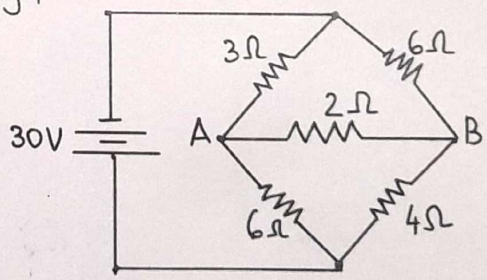


Fig.4



Q2. Fig. 2 shows a voltage divider circuit. Determine the voltage that can be measured at terminals A, B, and C with respect to the ground.

Q3. Use superposition theorem to determine current I_{AB} indicated in the circuit shown in Fig. 3.

Q4. Apply Thevenin's theorem across the terminals A and B in the circuit shown in Fig. 4. Draw the Thevenin equivalent circuit mentioning the value of Thevenin voltage and resistance.

Q5. An intrinsic Germanium rod has the following dimensions: length = 1cm; width = 1mm; and thickness = 1mm. At temperature $T = 300$K, the intrinsic carrier density in Germanium is 2.5×10^{13} cm^{-3}, the mobility of electrons is $\mu_e = 3900$ cm^{2}V^{-1}s^{-1} whereas the mobility of holes is $\mu_h = 1900$ cm^{2}V^{-1}s^{-1}. Determine ***(i)*** electrical conductivity, ***(ii)*** electrical resistivity, and ***(iii)*** electrical resistance of the given rod.

Q6. Determine built-in potential of the *p-n* homojunction formed in a Silicon sample by doping it with the acceptor atoms $N_A = 10^{15}$ cm^{-3} and with the donor atoms $N_D = 10^{15}$ cm^{-3} at $T =$ 300K. [Assume intrinsic carrier density at $T = 300$K to be 10^{10} cm^{-3}]

Q7. Consider the circuit shown in Fig. 5. For the input voltage $v_{in}(t) = 15$ Sin (314 t) V, and assuming the ideal diode model, plot the output waveform $v_{out}(t)$ indicating the values of maximum and minimum voltage.

Q8. Draw the waveform observed at terminals A, B, and C indicated in Fig. 6.

Fig. 5

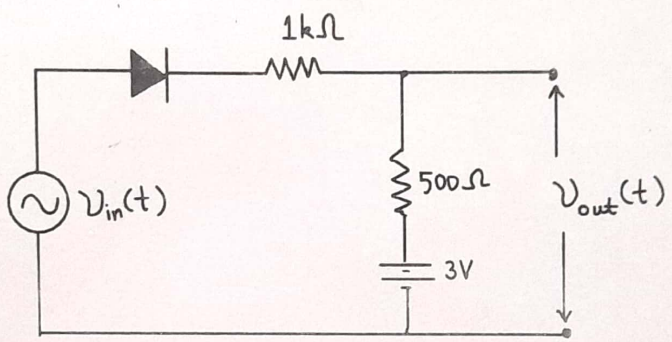


Fig. 6