Ahmedabad University

School of Arts and Sciences

PHY314 - Electrical Circuits and Electronics
Mid Term Examination 2022 (Monsoon Semester)

Total Marks = 100 **Time - 3 hours**

Enrolment number: .....
Date: 24/09/2022
No. of printed pages: 5

PART-A

Answer any 6 questions in part-A. Each question carries 4 marks. **6×4=24**

1. What are intrinsic and extrinsic semiconductor? What are p-type and n-type crystals? Is an n-type semiconductor negatively charged?

2. Explain why a semiconductor behaves as an insulator at 0 K. Why does the conductivity of a semiconductor increases with temperature?

3. What do you mean by ideal voltage and current source? How they are different from the practical voltage and current source (indicate their *current-voltage* characteristics)?

4. What is the importance of the network theorems? Are these theorems independent from Kirchhoff's laws?

5. How does the depletion region formed in p-n junction? Explain the variation of its width with biasing?

6. The emitter resistance R_E is by-passed by a capacitance C_E, explain the role of C_E in the circuit?

7. The power gain of an amplifier is 25 dB. If the input power is 100 mW, find the output power?

PART-B

Answer any 2 questions in part-B. Each question carries 10 marks. **2×10=20**

8. Prove that the maximum power is delivered from a network to a load impedance Z_L when Z_L is the complex conjugate of the internal impedance Z_T, measured looking back into the terminals of the network.

9. Using the superposition theorem find the current through the resistor R_2 for the circuit bellow.

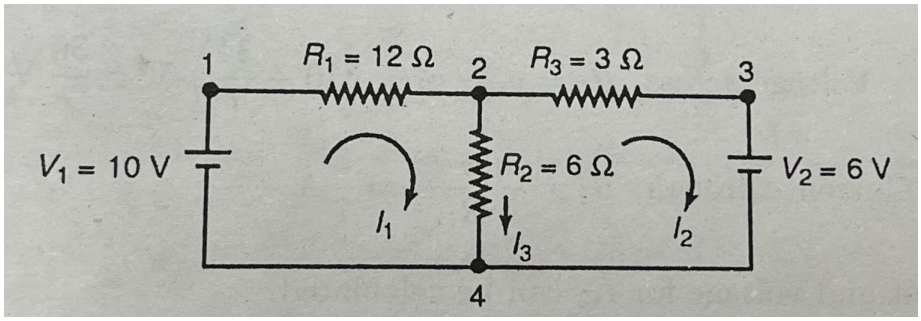


Figure 1:

10. Find the Q-point for the following emitter feedback circuit, with the following specifications.
$C_{CC} = 12V$, $R_C = 2.2K\Omega$, $R_E = 1.2K\Omega$, $R_B = 356K\Omega$, $\beta = 100$, assume $I_B >> I_{CBO}$.

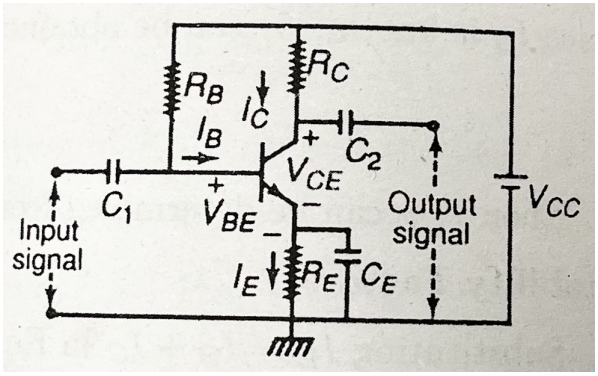


Figure 2:

PART-C

Answer any 5 questions in part-C. Each question carries 8 marks. **5×8=40**

11. Determine the collector current I_C and collector-emitter voltage V_{CE} for the circuit below. Neglect small base-emitter voltage. Given that $\beta = 50$. If R_B in this circuit is changed to $50k\Omega$, find the new operating point.

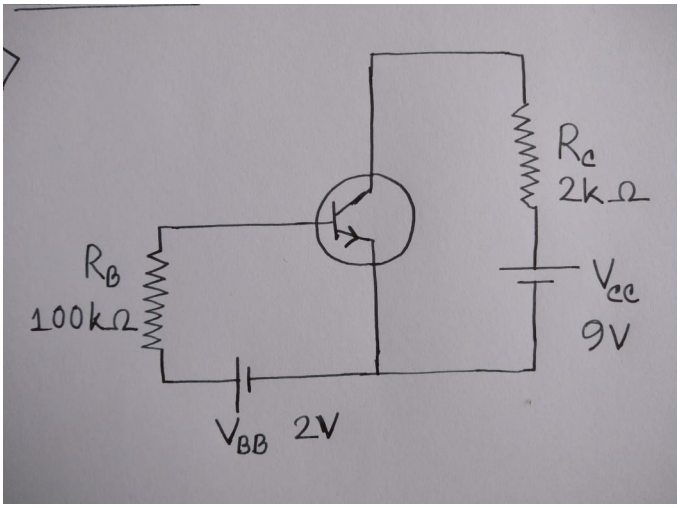


Figure 3:

12. Find the current through the 2Ω resistance in the circuit bellow.

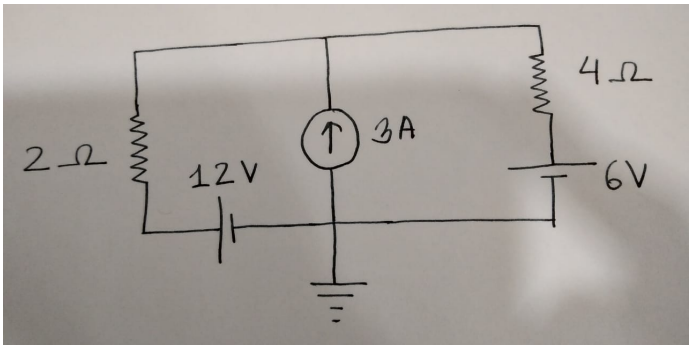


Figure 4:

13. Find the current through the 9Ω resistance in the circuit bellow.

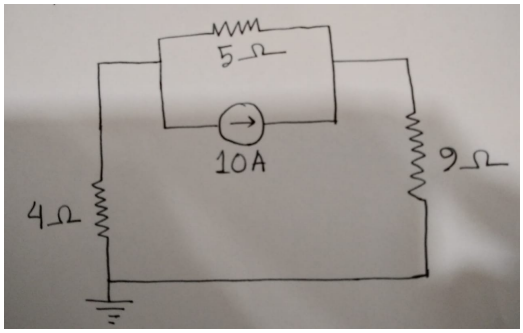


Figure 5:

14. Determine the current through the resistance 2Ω and the voltage V_S for the circuit given below.

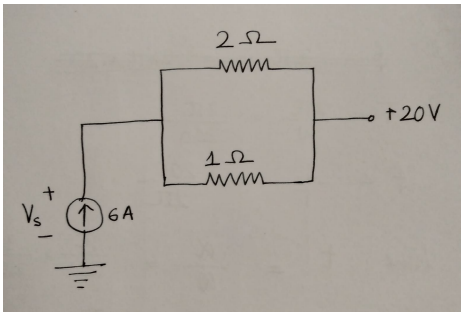


Figure 6:

15. For the circuit below, find the total capacitance, the charges on each plate of capacitor and the total charge.

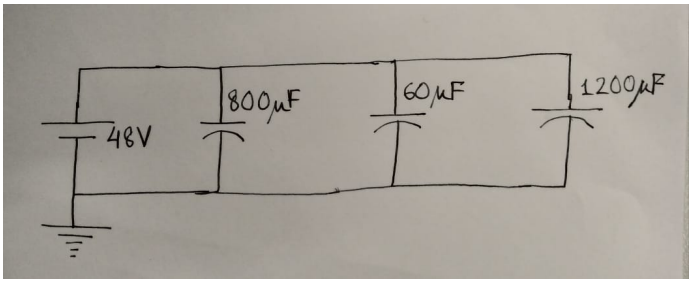


Figure 7:

16. For the circuit below, assuming $\beta = 260$, $V_{CC} = 12V$, $R_C = 560\Omega$, $R_E = 680\Omega$, $R_1 = 22K\Omega$ and $R_2 = 12K\Omega$ find the Q-point?

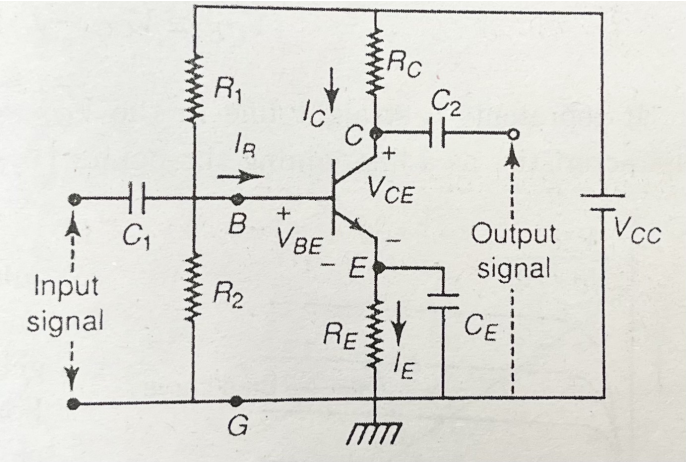


Figure 8:

PART-D

Answer any 4 questions in part-D. Each question carries 4 marks. **4×4=16**

17. Prove that the linear circuit theorem is not applicable for circuit network power.

18. A dc generator of *e.m.f* 20 V delivers a maximum power of 10 W to a load resistance. Calculate the internal resistance and its short circuit current?

19. Suppose two identical Si diodes are connected in parallel and then this combination is connected to a power supply of 5 V together with a series resistance 220Ω. Find the current through each of the diodes? Is there any advantage in connecting two such diodes in parallel?

20. In a half-wave rectifier prove that the efficiency of rectification is about 20.3% when the rectifier delivers maximum dc power to the load.

21. In a full-wave rectifier circuit the forward resistance of each diode is 20Ω, transformer secondary voltage from the center tap to each end is 30 V, 50 Hz and the load resistance is $1K\Omega$. Calculate the dc load current and the rectifier efficiency.