VIT
Vellore Institute of Technology

Final Assessment Test – June 2022

Course: BECE101L - Basic Electronics

Time: Three Hours

Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

Answer ALL Questions

(10 X 10 = 100 Marks)

1. (a) Determine the supply voltage for the given circuit in Figure.1. Assume that there is no voltage drop in the connecting wires. Also calculate the power supplied by the battery and power dissipated by the resistors. [5]

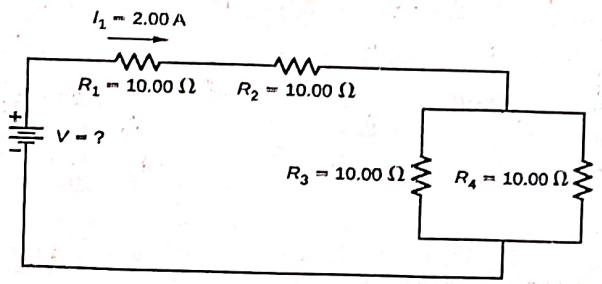

Figure.1

• (b) Determine the energy stored in the capacitor network shown in the Figure.2 . Assume all capacitors are fully charged and capacitance values are C_1=12.0 μF, C_2=2.0 μF and C_3=4.0 μF, respectively. [5]

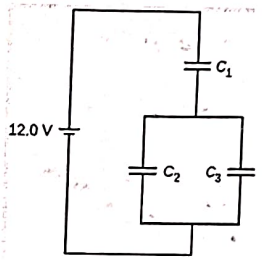

Figure.2

2. (a) i) Two identical samples of pure germanium are doped with donors whose concentrations are $3x10^{20}$ and $5x10^{20}$ respectively. If the hole concentration in the first sample is $9x10^{12}$, determine the hole concentration in the second sample provided the temperature is maintained constant. [5]

ii) The intrinsic carrier density at room temperature in Germanium is $2.37x10^{19}$ m^3. If the electron and hole mobilities are 0.38 and 0.18 $m^2V^{-1}s^{-1}$ respectively, determine the resistivity. [5]

OR

2. (b) As shown in Figure 3, the input voltage levels (V_S) are varied from 90V to 130 V for the voltage regulator circuit having a series resistance R of 5 kΩ and a load resistor R_L of 10 kΩ. Determine the following:

i) Is the Zener diode in ON or OFF state for the entire range of input voltage variation? Justify with proper reasons. [4]

ii) Maximum value of Zener diode current that will pass through the circuit. [3]

iii) Minimum value of Zener diode current that will pass through the circuit. [3]

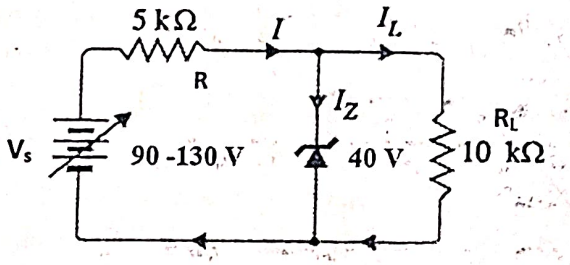

Figure.3

3. In the full wave rectifier circuit shown in the Figure.4, the diodes are assumed to be ideal. The ac supply voltage given is 230V, 50 Hz. Load resistance has a value of 100 Ω. The transformation ratio of the transformer is 5:1.

Determine the following:
(a) Maximum current (Im) (b) d.c current (Idc) (c) r.m.s. current (Irms) (d) dc power output
(e) rectifier efficiency

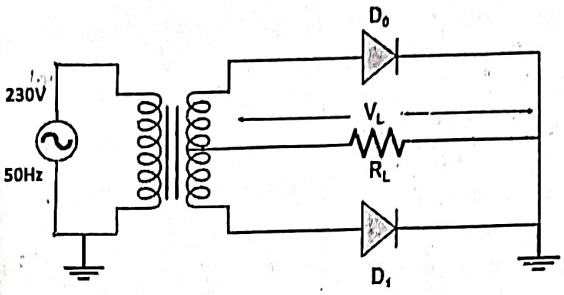

Figure.4

4. For the circuit shown in Figure.5, calculate (a) base current (b) collector current (c) V_{BE} (d) V_C (e) V_{CE} (f) V_{CB}. Assume, base and collector resistors are 25 kΩ and 200 Ω respectively, V_{BB}=8 V and V_{CC}=12V, β=120, Si transistor.

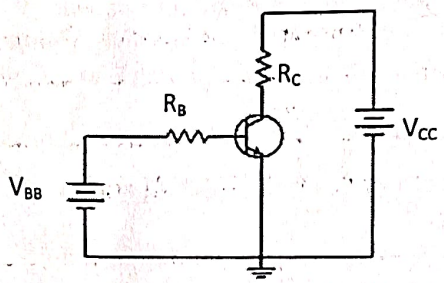

Figure.5

5. (a) A transistor is connected in Common Emitter (CE) configuration in which, collector supply is 8V and the voltage drop across resistance R_C connected in the collector circuit is 0.5V. The value of R_C = 800 Ω. If α = 0.96, determine: (i) collector-emitter voltage (ii) base current. [5]

(b) The data sheet for an E-MOSFET gives $I_{D(on)}$ = 200 mA at $V_{GS(on)}$ = 12V and Threshold voltage $V_{GS(th)}$ = 3V. Determine the drain current for V_{GS} = 7V. [5]

6. (a) With suitable diagram, explain the working principle of BJT Amplifier. [6]

(b) A Colpitt's oscillator oscillates at 1.13 MHz. If the inductor in the feedback network has a value of 20 μH, and one of the capacitors value is 0.1 μF, calculate the value of the other capacitor. [4]

7. Convert and find out the following numbers
a) $(BBC.A23)_{16}$ to $(?)_2$
b) (111110111.110) to $(?)_{10}$
c) $(1101001.10101) + (BD)_{16} = (?)_{10}$
d) $(356.45)_8 + (345)_8 = (?)_{10}$
e) $(223)_6 + (222)_6 = (?)_{10}$

8. (a) Simplify the following expressions and implement using Universal gates
(i) F = A'BC + AB'C' + A'B'C' + AB'C + ABC (ii) F = A'B'C + A'BC' + A'BC + ABC

OR

(b) Simplify the following using Boolean rules and draw the Logic circuit
i) (AB)'(A' + B)(B' + B)
ii) (A' + C)(AD + AD') + AC + C
iii) A'(A + B) + (B + AA)(A + B')

9. The following values were obtained from the measurements of the value of a resistor: 147.2 Ω, 147.4 Ω, 147.9 Ω, 148.1 Ω, 147.1 Ω, 147.5 Ω, 147.6 Ω, 147.4 Ω, 147.6 Ω and 147.5 Ω. Calculate (a) arithmetic mean, (b) average deviation, (c) standard deviation, treating the data as finite, and (d) standard deviation, treating the data as population.

10. Describe the working of a LDR (light dependant resistor) using suitable diagrams. Also explain how LDR principle can be used in an automatic street light control system.

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