BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – B.Sc. (Honours) in Computer Science

Course Name – Introduction to Electrical Circuits and Basic Electronics I

Course Code – EC101/ BCSG101

(Semester – 1)

Time allotted: 3 Hours **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question) 10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) If w is the width of the depletion region in p-n junction, the transition capacitance is proportional to

a. w
b. w^2
c. 1/w
d. $1/w^2$

(ii) Ripple factor of half wave rectifier is

a. 0.52
b. 1.21
c. 0.48
d. 1

(iii) The I-V characteristics of tunnel diode exhibit

a. current-controlled negative resistance
b. voltage-controlled negative resistance
c. temperature-controlled positive resistance
d. current-controlled positive resistnce

(iv) In a junction transistor, recombination of electrons and holes occurs in

a. base region only
b. emitter region only
c. collector region only
d. all the three regions

(v) If $\alpha = 0.98$, then β is equal to

a. 0.49 b. 49

c. 50 d. 0.5

(vi) The diffusion capacitance of p-n junction diode

a. increases with forward bias voltage b. decreases exponentially with forward bias voltage

c. decreases with forward bias voltage d. increases with forward bias voltage

(vii) Kirchhoff's voltage law is used for

a. loop analysis b. nodal analysis

c. finding out equivalent resistance d. none of these

(viii) In a linear circuit, the superposition principle can be applied to calculate

a. voltage and power b. voltage and current

c. current and power d. voltage, current and power

(ix) The transformer turns ratio determines

a. all b. the ratio of primary and secondary currents

c. the ratio of secondary and primary voltages d. the reflected impedance

(x) Four capacitors each of 40 µF are connected in parallel, the equivalent capacitance of the system will be

a. 160 µF b. 10 µF

c. 40 µF d. 5 µF

Group – B

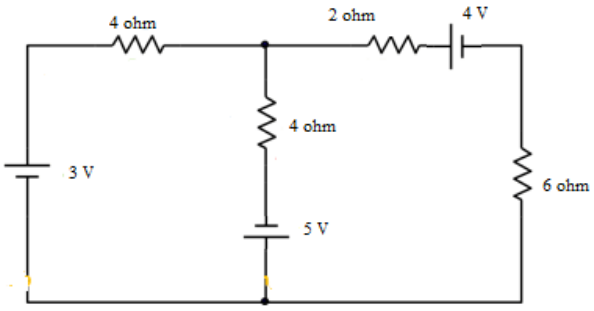
(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. Explain the action of Zener diode, illustrating both avalanche break no gap down and Zener break down. 5

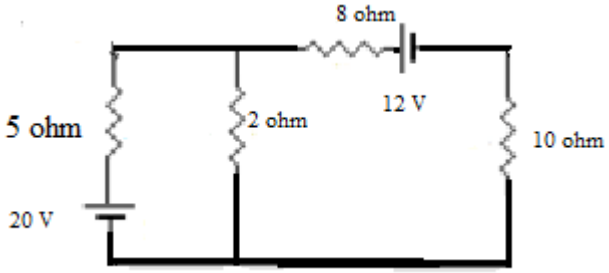
3. Find out the relation between α and β for a transistor, where notations have their usual meanings. Find α and I_C of a transistor with β =49 and I_E =12 mA. 3+2

4. Find current in 6 ohm resistor using Norton's theorem for the network shown in figure below: 5



5. 27 spherical drops, each of same size, are charged at 220 V each. They coalesce to form a bigger spherical drop. Calculate the potential of the bigger drop. 5

6. For the circuit shown in figure, calculate the current in the 10 ohm resistance. Use Thevenin's theorem. 5



Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) Derive an expression for conductivity of an extrinsic semi-conductor in terms of carrier concentration. 5

   (b) At 300K the intrinsic concentration of silicon is 1.5×10^{16} m^{-3}. If the electron and the hole mobilities are 0.13 $m^2/(Vs)$ and 0.05 $m^2/(Vs)$ respectively, determine the intrinsic conductivity and resistivity of silicon at 300K. 5

(c) Draw the circuit diagram of a full wave rectifier using p-n junction diodes and explain its operation. 5

8. (a) Explain the term resonance in electrical circuits subjected to alternating voltage. Find the condition for resonance in case of series L-C-R circuit fed by alternating voltage. In series L-C-R circuit at resonance, potential difference across which of L, C and R equal the applied voltage? Justify. 2+5+2

(b) An alternating voltage 100 V, 1000 Hz is applied to series combination of a 100 Ω resistor and 10 μF capacitor. Calculate circuit current, potential difference across the capacitor and potential difference across the resistor. 6

9. (a) What is quality factor (Q) for an a.c circuit**?** Prove that in case of series LCR circuit, the quality factor (Q) is given by $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$ 2+3

(b) Illustrate wattless current in ac circuit. What is its importance? 4+1

(c) An alternating emf of 14 volt (r.m.s) is applied to a circuit containing an inductance of 0.2025 H, a capacitance of 50 μF and a resistance of 0.2Ω connected in series. Determine i) the resonant frequency ii) the potential difference across the inductance and iii) the Q-factor. 2+2+1

10. (a) Show that when a charged capacitor is allowed to discharge through a resistor, the decay of charge is exponential. 5

(b) What is the time constant? Draw q vs t graph for two time constants λ_2 and λ_1 when $\lambda_2 > \lambda_1$. What is the unit of time constant? 5

(c) When a charged capacitor of 2μF is discharged through a resistance, it losses 50% of the charge in 5 min. Find the unknown resistance. Neglect natural leakage. 5

11. (a) Why n-p-n and p-n-p transistors are called bipolar transistors? 2

(b) Discuss the input and output characteristics of npn transistor in CB configuration. What is early effect? 6+2

(c) If β=16.5, I_E =1.8 mA and I_{CO} =12 μA, calculate I_c and I_B when the transistor is used in CE configuration. 5
