RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2018

FIRST YEAR [BATCH 2018-21]

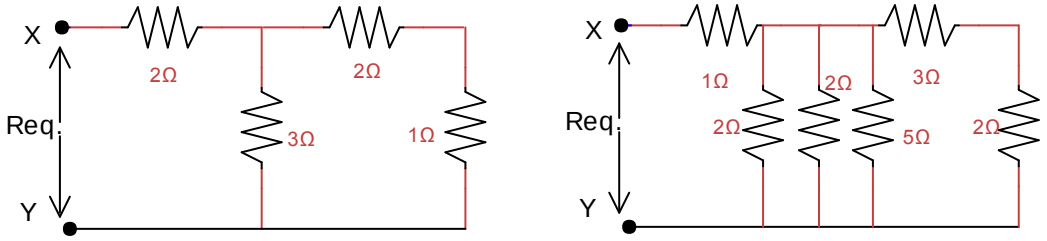
Date : 19/12/2018 **ELECTRONICS [General]**

Time : 11 am – 1 pm **Paper : I** Full Marks : 50

Answer ***any five*** questions: [5 × 10]

1. a) A Delta network having resistances R_1, R_2 and R_3 , is to be converted into a star network with resistance R_x, Ry and Rz. Find expressions for Rx, Ry, Rz in terms of R_1, R_2 and R_3. [4]

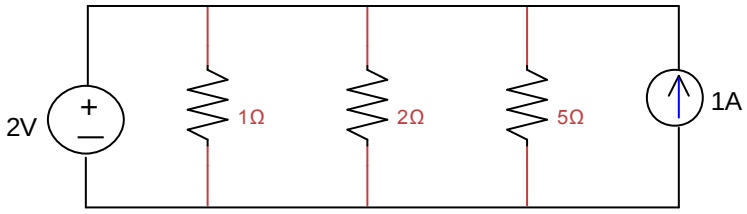
   b) Find the equivalent resistance for the given circuits: [2+2]



   c) What do you mean by independent and dependent voltage source? Explain. [2]

2. a) State Kirchoff's Voltage Law (KVL). Explain KVL with a neat diagram. [1+2]

   b) What is the power absorbed in the 5 Ω resistance in the given circuit: [3]



   c) State Nortorn's theorem. Prove that $I_N = \frac{V_{Th}}{R_{Th}}$, where, I_N is the current supplied by the Norton's equivalent current source of a given circuit, V_{Th} and R_{Th} are the Thevenin equivalent voltage source and resistance respectively of the given circuit. [1+3]

3. a) Compare forbidden band gaps of metal, insulator and semiconductor. [2]

   b) A semiconductor has band gap energy 3.313 eV. Find the wavelength of the emitted radiation when the semiconductor is excited by a suitable excitation. [3]

   c) Compare drift and diffusion process in semiconductors. [3]

   d) Explain why at high temperature an extrinric semiconductor behaves like an intriuric one. [2]

4. a) Draw a Bridge rectifier circuit, Explain its principle of working. [4]

   b) Define ripple factor. Prove that ripple factor,

$$\gamma = \left[\left(\frac{I_{rms}}{I_{dc}} \right)^2 - 1 \right]^{1/2}$$

   where, I_{rms} and I_{dc} are the rms value and de value of the load current respectively. [4]

   c) Explain how Zener diode can act as a voltage regulator. [2]

5. a) What is bipolar junction transistor? [1]
   b) Discuss how a transistor can be used as a current amplifier. [3]
   c) Explain the current amplification factors α and β for CB and CE configurations, respectively of a pnp transistor. Obtain a relation between them. [3]
   d) A transistor having $\alpha = 0.99$ is used in a CB amplifier. If the load resistance is 4.5 KΩ and the dynamic resistance of the emitter-base junction is 50 Ω, find the voltage gain and the power gain. Also Calculate β of the transistor. [3]

6. a) When is the channel of a JFET said to be pinched off? Sketch the depletion region before and after pinch-off of the JFET. [2+2]
   b) Explain the advantages of FETs over BJTs. [3]
   c) What is the difference between an enhancement type and a depletion type MOSFET? Explain in detail. [3]

7. Write short notes on ***any four*** of the following: [4 × 2.5]
   a) Thevenin's theorem
   b) LED
   c) Avalanche breakdown.
   d) Output characteristics of BJT (CE mode)
   e) Rectification efficiency
   f) h parameters

8. Answer ***any five*** of the following: [5 × 2]

   a) 'The energy levels of an atom produce energy bands in a crystal' — Explain. [2]
   b) Draw and explain drain characteristics of MOSFET. [2]
   c) A zener diode is specified with ratings 5.5 V and 1.1 W. What is the maximum allowable current that can pass through it? [2]
   d) Prove that dynamic resistance of a diode,

$$r_{ac} = \frac{\eta}{39(I + I_s)}$$

   Where, $\eta \equiv$ diode ideality factor, I_s = reverse saturation current through the diode and $I \equiv$ current flowing through the diode. [2]
   e) Explain charging of a capacitor in CR circuit. [2]
   f) Prove that the hybrid parameter h_{fe} is equivalent to β', the small signal short-circuit current gain in CE mode BJT. [2]
   g) Explain briefly superposition theorem. [2]
   h) For a field-effect transistor , prove that

$$\mu = r_d g_m$$

   where, $\mu \equiv$ amplification factor, $r_d \equiv$ output resistance and $g_m \equiv$ trans-conductance. [2]

———— × ————