No. of Printed Pages : 7

BIEE-033

DIPLOMA IN ELECTRICAL ENGINEERING (DELVI)

Term-End Examination

01275

December, 2014

BIEE-033 : ELECTRICAL CIRCUIT THEORY

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. All questions carry equal marks. Use of scientific calculator is allowed. Assume missing data, if any.*

1. (a) (i) Define Ohm's Law. 2

(ii) A two terminal device is supplied with a variable voltage source. The across voltage and through current are measured as tabulated below :

Voltage (mV)	Current (μA)
– 4	– 6
– 2	– 3
0	2×10^{-6}
3	4·5
5	7·5

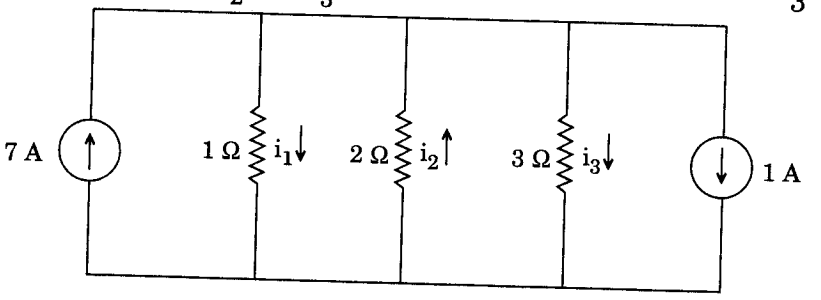
(1) Plot the current vs voltage characteristic. 2

(2) State with proper reason whether this device obeys Ohm's Law. 1

(3) Compute the effective conductance and resistance of this device. 2

(b) (i) Define Kirchhoff's Current Law and Kirchhoff's Voltage Law using mathematical expressions and diagrams. 2+2

(ii) In the following circuit, determine i_1, i_2 and i_3 : 3

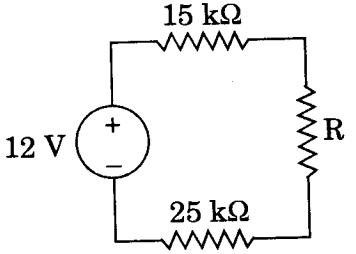


2. (a) Draw and explain the power triangle. 7

(b) In the circuit shown below, determine the resistance, R that will result in the

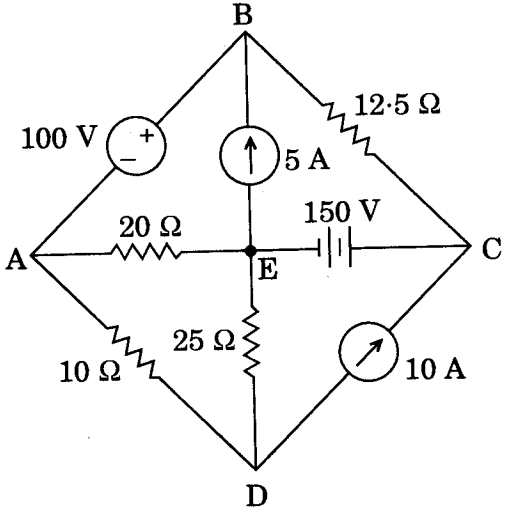
(i) 25 kΩ resistor absorbing 2 mW of power, $3\frac{1}{2}$

(ii) 12-V source delivering 3·6 mW to the circuit : $3\frac{1}{2}$

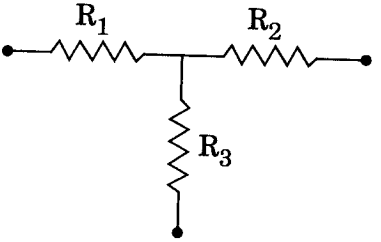


3. (a) (i) State the condition in a network analysis that requires defining a super node. *2*

(ii) In the following circuit diagram, determine the voltages, V_A and V_B w.r.t. V_E using nodal method of analysis. *5*



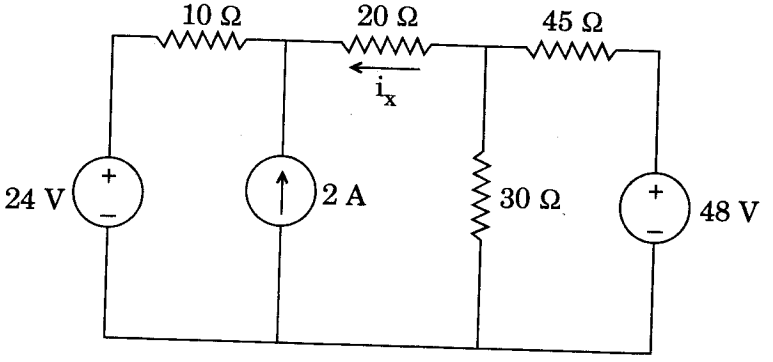
(b) (i) Given below is a star connected network.



With proper diagram, show an equivalent delta connected network. Express the resistances of Δ network in terms of R_1, R_2 and R_3. *2*

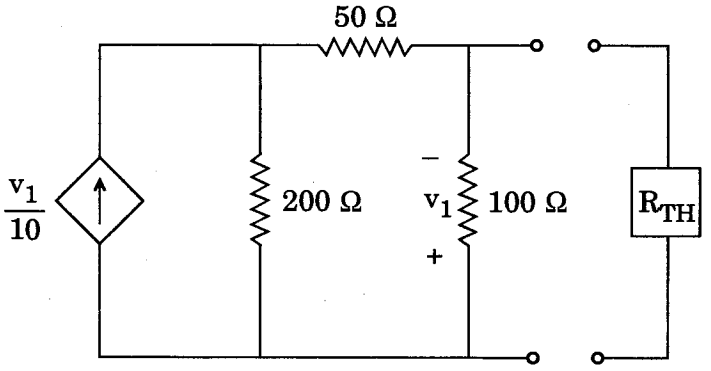
(ii) Define Superposition theorem. *1*

(iii) Determine the current i_x through the 20 Ω resistor in the following circuit : *4*



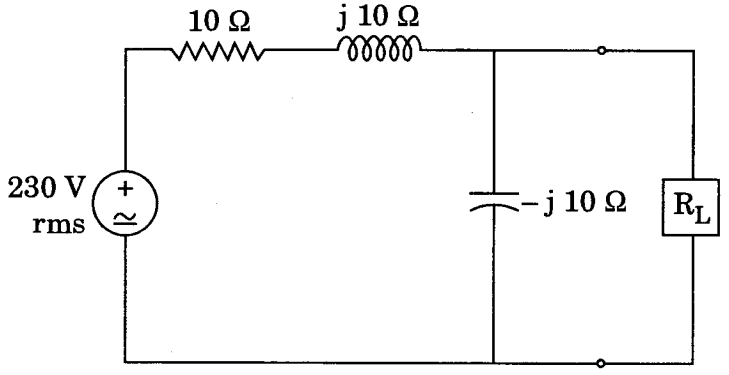
4. (a) (i) With the help of diagrams, explain the transformation from a practical voltage source to a practical current source. *2*

(ii) Use source transformation to determine R_{TH} in the following circuit : *5*

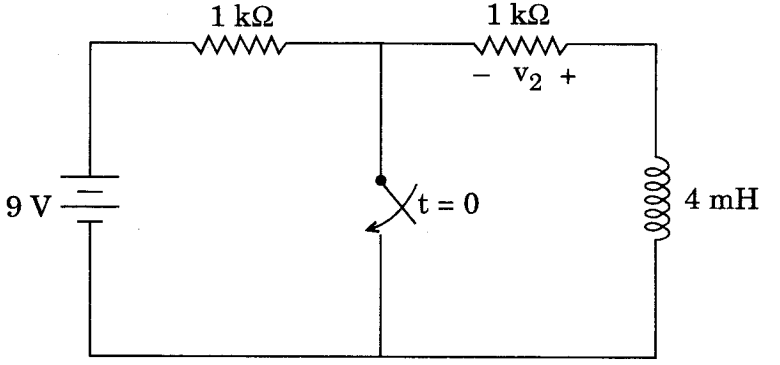


(b) (i) State Maximum power transfer theorem in terms of Thevenin's Equivalent Impedance. *2*

(ii) In the following circuit, what is the maximum average power delivered to the load if it is purely resistive ? *5*



5. (a) In the following circuit, switch is closed at time, t = 0 : 7

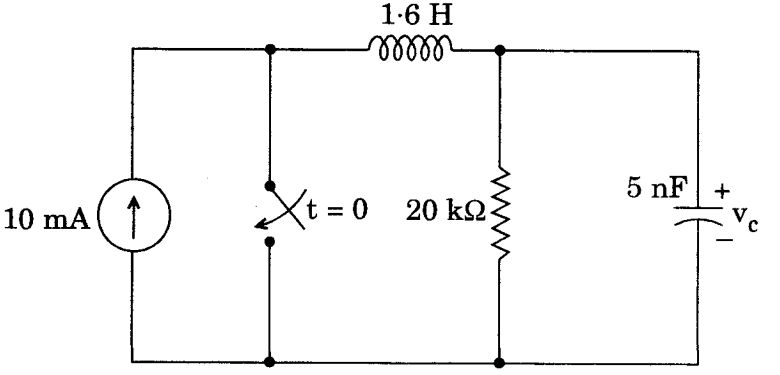


Determine the voltage v_2 at t = 5 μs. 7

(b) Define power factor and explain the energy associated with Capacitive and Inductive circuits. 7

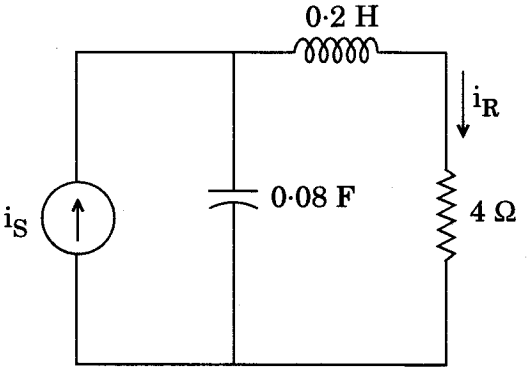
6. (a) Draw a source free parallel RLC circuit. Derive roots of the differential equation in terms of R, L and C. 7

(b) The switch in the following figure is closed at time, t = 0.



Determine the voltage v_c across the capacitor as a function of time. 7

7. (a) Consider the following figure :



Given $i_R = 20 \angle 25°$ at $\omega = 10$ rad/sec. Determine i_S as a complex forcing function. 7

(b) Draw two separate phasor diagrams to represent i_R and i_S in Q. 7(a). 7

8. (a) Using circuit diagram, obtain the condition for resonance in parallel RLC circuit from fundamentals. 7

(b) A parallel resonant circuit has $f_0 = 1$ kHz, $Q_0 = 40$, and $|Z_{in}(j\omega_0)| = 2$ kΩ. Determine its Z_{in} at 1010 Hz. 7