TUTORIAL QUESTIONS DC CIRCUITS

Question 1

Apply kirchoff 2nd law (loop rule),

$\sum emf = \sum p.d.$

$5.5 - 1.2 = I\,(1.0+0.2)$

$I = 3.58\ A$

Question 2

a.) $R_p = (18//6.0) = 4.5\ \Omega$

b.) $R_T = R_p + 3.5 = 8\ \Omega$

c.) $I_T = E/R_T = 16 / 8 = 2\ A$

d.) $V_1 = I_T R_P = (2)\,(4.5) = 9\ V$

e.) $V_2 = I_T R_{3.5} = (2)\,(3.5) = 7\ V$

f.) $I_2 = V_1 / R_6 = (9) / (6.0) = 1.5\ A$

$I_3 = V_1 / R_{18} = (9) / (18.0) = 0.5\ A$

Question 3

Part (a)

$I_1 = 18 / 6 = 3\ A$; $I_3 = 18 / 6 = 3\ A$

Part (b)

$R_{parallel} = (6//8//24) = 3\Omega$

$V_{parallel} = (3/15)\,(18) = 3.6\ V$

$I_1 = 3.6 / 6 = 0.60\ A$; $I_3 = 3.6 / 24 = 0.15\ A$

$I_2 = 3.6 / 8 = 0.45\ A$; $I = I_1 + I_2 + I_3 = 1.20\ A$

Question 4

Network A

$R_T = (6.0//3.0) + 8.0 + 5.0 = 15\ \Omega$

$I_1 = V / R_T = 1.5 / (15) = 0.1\ A$

Network B

$R_T = [(10 + 20 + 30)//60] + 20 + [(30 + 50 + 20)//100]$

$R_T = 100\ \Omega$

$I_1 = V / R_T = 50 / (100) = 0.5\ A$

Question 5

a.) i.) $V_L = V_i\,[R_L / (R_L + R)] = (12)\,[8M / (8M + 10k)]$

$V_L = 11.99\ V$

ii.) $V_L = 0.57\ V$

b.) $V_L = V_i\,[R_L / (R_L + R)]$

$4. = (12)\,[R_L / (R_L + 10k)]$

$R_L = 5000\ \Omega$

Question 6

$V_{out} = V_i\,[R_L / (R_L + R)]$

At 20°C,

$V_{out} = (10)\,[20\ k / (20\ k + 1k)]$

$V_{out} = 9.52\ V$

At 60°C,

$V_{out} = (10)\,[100 / (100 + 1k)]$

$V_{out} = 0.91\ V$

Question 7

$V_1 / V_2 = L_1 / L_2$

$V_1 = (L_1 / L_2) V_2 = (64 / 44) (1.02) = 1.48$ V

Question 8

a.) $I = V_o / R_{wire} = 0.01 / 2 = 5$ mA

$R = (1.5 - 0.01) / 5$ m $= 298\ \Omega$

b.) $V_1 = (L_1 / L_2) V_2 = (65 / 100) (0.01)$

$V_1 = 6.5 \times 10^{-3}$ V

Question 9

i.) $(1.5 / 2.0) = (L / 100)$

$L = 75$ cm

ii.) Max p.d. across XY is now:-

$V_{XY} = [5/(5+1)](2) = 1.67$ V

$(1.5 / 1.67) = (L / 100)$

$L = 90$ cm

iii.) $(1.5 / 2.0) = (L / 100)$

$L = 75$ cm (the resistor in series with B will have no effect when the potential is balanced)

iv.) To obtain zero deflection the length must be equal to the terminal p.d. of source B.

Terminal p.d. across B $= [1/(1+0.8)](1.5) = 0.83$ V

$(0.83 / 2.0) = (L / 100)$

$L = 41.7$ cm