U210 Electrical Engineering
Homework Solutions

Assignment 1: 1.1.1, 1.1.2, 1.1.4*, 1.1.7, 1.1.11, 1.1.20
1.1.1 $F=9x10^9$ N or $1.01x10^6$ ton-force
1.1.2 $F_N=((3)^{1/2}/a^2)$ with $F_1=F_2=F_3$
1.1.4 location of point charge is (2,2,-1) with $Q=(24\pi\varepsilon_0)$ C
1.1.7 v(t)=(50+t) C; i=dq/dt = 1 A
1.1.11 F at (3,4,2) = $0.0002(3a_x+4a_y)$ N
1.1.20 230 hrs; 5 MJ

Assignment 2:1.2.5, 1.2.6, 1.2.7, 1.2.8, 1.2.9, 1.2.13(a), 1.2.14, 1.2.18, 1.2.19

1.2.5 3 Ohms
1.2.6 10 Ohms
1.2.7 2 Ohms
1.2.8 8 Ohms
1.2.9 12.4% increase in power with matching load
1.2.13 (a) $V_{RMS}I_{RMS} = V_{RMS}^2/R$
1.2.14 a) 4.8 kW; b) 1.44 kW; c) 7.2 kW; d) 1.8 kW
1.2.18 V_x=1.5 V
1.2.19 a) -2A; b) -5 A; c) 2 A; d) 1.5 A

Assignment 3: 1.3.1, 1.3.2, 1.3.5, 1.3.6, 1.3.10

1.3.1 V_B=2 V; V_C=8V; V_G=14V; I_A=-1A; I_D=-1 A; I_E=2A; I_F=2 A; I_H=1A; Power delivered to each element: A=6 W (sink); B=4 W (sink); C=-8W (source); D=8W (sink); E=8 W(sink); F=20 W (sink); G=-42 W(source); H=4W (sink); conservation of power is satisfied.
1.3.2 V=2V
1.3.5 V_1=35V; V_2=-15V; P_{V1}=175 W; P_{V2}=75 W; P_R=250W; power absorbed by resistors equal power provid3ed by sources therefore conservation of power is satisfied.
1.3.6 a) V=914.3 V; b) I_1=45.7 A; I_2=22.86 A; I_3=11.43 A; c) P_A=27.4 kW; P_B=45.7 kW; P_R=73.1kW; power absorbed by resisters equals power provided by sources therefore conservation of power is satisfied.
1.3.10 V_{out}=-5V; I=0.5mA; P=1.25mW

Assignment 4: 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.4, 2.2.9, 2.2.10

2.1.1 a) R_{th}=6 Ohms,V_{th}=1 V b) R=6Ohms c) P=1/24 Watts
2.1.2 V_{th}=8 V, R_{th}=4 Ohms, I_N=2 A
2.1.3 V_{th}=72 V, R_{th}=4 Ohms, I_N=18 A
2.2.2 I=1 Amp
2.2.4 Nodal analysis leads to V_C=54 V (the voltage across the 12 Ohm R); Using mesh analysis I_2=4.5 A where $V=12I_2 = 54$ V

2.2.9 Nodal analysis leads to V_A=12 V, V_B=-6V where V_B=V=-6 V; using mesh analysis I_{loop} (=I_L)= 3 A, VB=2I_L-4I_1=-6V