Scilab Textbook Companion for Physics Demystified by Stan Gibilisco[1]

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Book Description

Title: Physics Demystified

Author: Stan Gibilisco

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

List of Figures

Chapter 3

Graphing Schemes

check Appendix AP 16 for dependency:

`GraphSolveQL.sci`

check Appendix AP 15 for dependency:

`QuadPointsPlot.sci`

Scilab code Exa 3.1 `Ch3 Examples`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
//Refer Dependency codes QuadPointsPlot.sci and
   GraphSolveQL.sci
/***Caution:- Dependency code 'QuadPointsPlot.sci'
   must be executed first and then the dependency
   code 'GraphSolveQL.sci' should be executed***/

//Example A , Page 55
deff('[y]=f1(x)','y=x^2+2*x+1');
funcprot(0)
 //Comparing the given equation y=x^2+2*x+1 with y=a
   *x^2+b*x+c
a=1;
```

```
b=2;
c=1;
Rect1=[-5,-2,5,8]; //rect for axes in Graph
printf("\nExample A, Page 55\n")
printf("----------------------\n")
printf("For the Equation y = x^2+2x+1\n ")
QuadPointsPlot(a,b,c,f1,Rect1,0)
xtitle("Fig. 3-6. Plot of the parabola y=x^2+2x+1.",
    "x","y")

//Example B , Page 56
deff('[y]=f2(x)','y=-2*x^2+4*x-5');
funcprot(0)
 //Comparing the given equation y=-2x^2+4*x-5 with y
    =a*x^2+b*x+c
a=-2;
b=4;
c=-5;
Rect2=[-5,-16,5,4]; //rect for axes in Graph.
printf("\nExample B, Page 56\n")
printf("----------------------\n")
printf("For the Equation y = -2x^2+4x-5\n ")
QuadPointsPlot(a,b,c,f2,Rect2,1)
xtitle("Fig. 3-7. Plot of the parabola y=-2x^2+4x-5.
   ", "x","y")

//Example A, Page 59
deff('[y]=f1(x)','y=x^2+2*x+1');
funcprot(0)
deff('[y]=g1(x)','y=-x+1')
funcprot(0)
printf("\nExample A, Page 59\n")
printf("----------------------\n")
GraphSolveQL(f1,g1,Rect1,2)
xtitle("Fig. 3-9. Graphical method of solving
   equations y=x^2+2x+1 and y=-x+1.", "x","y")

//Example B, Page 60
```

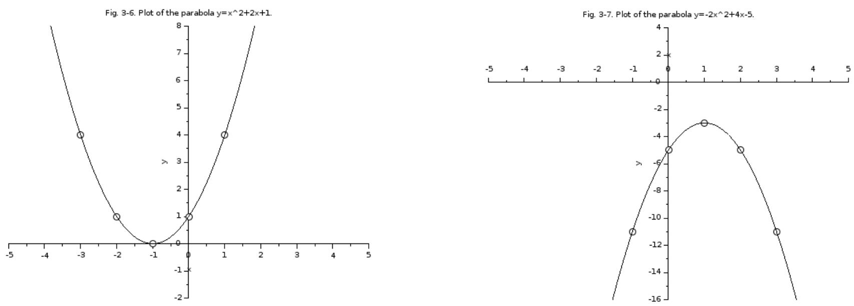
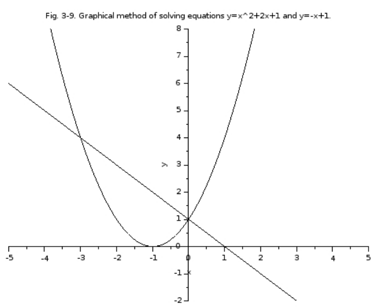


Figure 3.1: Ch3 Examples

```
deff('[y]=f2(x)','y=-2*x^2+4*x-5');
funcprot(0)
deff('[y]=g2(x)','y=-2*x-5')
funcprot(0)
printf("\nExample B, Page 60\n")
printf("---------------------\n")
GraphSolveQL(f2,g2,Rect2,3)
xtitle("Fig. 3-10. Graphical method of solving
    equations y=-2x^2+2x-5 and y=-2x-5.", "x","y")
```



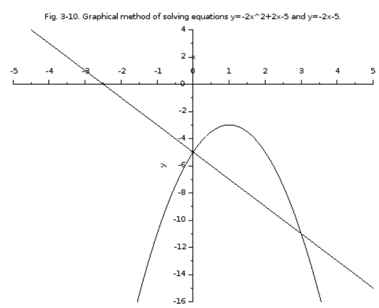


Figure 3.2: Ch3 Examples

Chapter 6

Units and Constants

Scilab code Exa 6.1 `Ch6 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-1
//Given
f_GHz=5;  //Clock Frequency of microprocessor, GHz

//Computations
f_Hz=f_GHz*10^9;

printf("The frequency is %1.0E Hz.", f_Hz)
```

Scilab code Exa 6.2 `Ch6 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-2
```

```
//Given
C_muF=0.001;   //Capacitance , microFarad

///Computation
C_F=C_muF*10^-6; //in Farad

printf("The Capacitance is %1.0E F(Farad).",C_F)
```

Scilab code Exa 6.3 Ch6 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-3
//Given
I_mH=0.1;   //Inductor Value , mH

///Computation
I_muH=I_mH*10^3; //in microhenrys

printf("%.1f mH = %.0f microhenrys(muH).",I_mH,
    I_muH)
```

Scilab code Exa 6.4 Ch6 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-4
//Given
M_kg=63;   //Mass , kg

///Computation
```

```
M_lb=M_kg*2.205; //in pounds

printf("The Mass is %.0f pounds.",M_lb)  //The
    answer may vary due to round off/ significant
    figures.
```

Scilab code Exa 6.5 Ch6 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-5
//Given
Speed_kmph=90;  //Posted speed limit , km/h

///Computation
Speed_miph=Speed_kmph*10^3*6.214*10^-4; //in miles/h

printf("The speed limit is %.0f miles per hour(mi/h)
    .",Speed_miph)
```

Scilab code Exa 6.6 Ch6 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 6-6
//Refer to Problem 6-5
//Given
Speed_kmph=90;  //Posted speed limit , km/h

///Computation
Speed_ftps=Speed_kmph*10^3*3.281/3600; //in feet/sec
```

```

printf("The speed limit is %.0f ft/s.",Speed_ftps)
```

Chapter 7

Mass Force and Motion

Scilab code Exa 7.1 `Ch7 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-1
//Theoretical Example - Involves No Calculations
```

Scilab code Exa 7.2 `Ch7 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-2
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.3 `Ch7 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-3
//Theoretical Example - Involves no computation
```

check Appendix ?? for dependency:

Fig7_5.png

Scilab code Exa 7.4 Ch7 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 7-4
//Refer the graph in Fig.7.5
//From the Graph
t=10; //Time span in seconds
D=20; //Total Displacement, m

//Computations
V=D/t; //Speed, m/s
//As speed by Curve A is constant
V_inst=V;  //Instantaneous Speed at t=5s, m/s

printf("The speed at t=5 s is V_inst = %.0f m/s.",
   V_inst)
```

check Appendix ?? for dependency:

Fig7_5.png

Scilab code Exa 7.5 Ch7 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 7-5
//Refer the graph in Fig.7.5
//From the Graph
t=10; //Time span in seconds
D=20; //Total Displacement , m

//Computations
V=D/t; //Speed , m/s
//As speed by Curve A is constant
V_avg=V;  //Average Speed betweent=3s to t=5s , m/s

printf("The average speed is V_avg = %.0f m/s.",
   V_avg)
```

Scilab code Exa 7.6 Ch7 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-6
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.7 Ch7 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-7
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.8 `Ch7 Problem 8`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-8
//Theoretical Example - Involves no computation
```

check Appendix ?? for dependency:

`Fig7_9.png`

Scilab code Exa 7.9 `Ch7 Problem 9`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 7-9
//Refer the graph in Fig.7.9
//From the Graph
t=10; //Time span in seconds
v=abs(0-10); //change in speed, m/s

//Computations
a=v/t; //acceleration, m/s^2
//As acceleration depicted by Curve A is constant
a_inst=a;  //Instantaneous acceleration at t=4s, m/s
    ^2

printf("The acceleration at t=4 s is a_inst = %.0f m
    /s^2.", a_inst)
```

check Appendix ?? for dependency:

Fig7_9.png

Scilab code Exa 7.10 Ch7 Problem 10

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 7-10
//Refer the graph in Fig.7.9
//From the Graph
t=10; //Time span in seconds
v=abs(0-10); //change in speed, m/s

//Computations
a=v/t; //acceleration, m/s^2
//As acceleration depicted by Curve A is constant
a_avg=a;  //Average acceleration betweent=2s to t=8s
    , m/s^2

printf("The average acceleration is a_avg = %.0f m/s
    ^2.", a_avg)
```

Scilab code Exa 7.11 Ch7 Problem 11

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-11
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.12 Ch7 Problem 12

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-12
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.13 Ch7 Problem 13

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-13
//Theoretical Example - Involves no computation
```

Scilab code Exa 7.14 Ch7 Problem 14

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 7-14
//Given
m=10500; //mass of spacecraft, kg
F=100000; //Force in direction of North star, N

//Computations
a=F/m; //acceleration, m/s^2

printf("The acceleration is %.4f m/s^2 towards North
    Star.", a)
```

Scilab code Exa 7.15 Ch7 Problem 15

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
// Problem 7-15
//Theoretical Example - Involves no computation
```

Chapter 8

Momentum Work Energy and Power

Scilab code Exa 8.1 `Ch8 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-1
//Given
m=2.0; //mass, kg
v1=50; //Initial velocity in Northerly direction, m/s
v2=25; //Final velocity in Northerly direction, m/s

//Computations
p1= m*v1; //original momentum, kg-m/s
p2=m*v2; //Final Momentum, kg-m/s
P=p2-p1; //Change in Momentum, kg-m/s

printf(" The impulse is %.0f kg-m/s in Northerly direction or %.0f kg-m/s in Southerly direction.", P, -P)
```

Scilab code Exa 8.2 Ch8 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-2
//Given
m_a=1.60; //mass of train A, kg
m_b=2.50; //mass of train B, kg
v_a= +0.250; //velocity of train A (towards east), m
    /s
v_b= -0.500; //velocity of train B (towards west), m
    /s

//Computations
p_a=m_a*v_a; //in kg-m/s
p_b=m_b*v_b; //in kg-m/s
p=p_a+p_b;  //in kg-m/s
m=m_a+m_b;  //in kg
v=p/m; //Velocity of composite train, m/s

if v>0
    printf("The composite train, after crash, will
        move east at %.3f m/s.",v)
end

if v<0
    printf("The composite train, after crash, will
        move west at %.3f m/s.",-v)
end

if v==0
    printf("The composite train, after the crash, is
         at rest.")
```

```
end
```

Scilab code Exa 8.3 Ch8 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-3
//Given
m_a=2.00; //mass of train A, kg
m_b=1.00; //mass of train B, kg
v_a= +0.250; //velocity of train A (towards east), m/s
v_b= -0.500; //velocity of train B (towards west), m/s

//Computations
p_a=m_a*v_a; //in kg-m/s
p_b=m_b*v_b; //in kg-m/s
p=p_a+p_b;  //in kg-m/s
m=m_a+m_b;  //in kg
v=p/m; //Velocity of composite train, m/s

if v>0
    printf("The composite train, after crash, will move east at %.3f m/s.",v)
end

if v<0
    printf("The composite train, after crash, will move west at %.3f m/s.",-v)
end

if v==0
    printf("The composite train, after the crash, is
```

```
        at rest.")
end
```

check Appendix ?? for dependency:

Fig8_4.png

Scilab code Exa 8.4 `Ch8 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-4
//Refer Fig.8-4
//Given
m=1.0;  //mass, kg
a_g=9.8;  //Acceleration due to gravity, m/s^2
q=1.5; //distance lifted, m

//Computations
F=m*a_g; // Force, kg-m/s^2
w=F*q;    //Work, kg-m^2/s^2

printf("The work done = %.0f kg-m^2/s^2.",w)
```

check Appendix ?? for dependency:

Fig8_4.png

Scilab code Exa 8.5 `Ch8 Problem 5`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
```

```
//Problem 8-5
//Refer Fig.8-4
//Given
m=5.004;  //mass, kg
a_g=9.8067;  //Acceleration due to gravity, m/s^2
q=3.00; //distance lifted, m

//Computations
F=m*a_g; // Force, kg-m/s^2
E_p=F*q;   //Potential Energy, J

printf("The potential energy, E_p = %.1f J.",E_p)
```

check Appendix ?? for dependency:

`Fig8_4.png`

Scilab code Exa 8.6 `Ch8 Problem 6`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-6
//Refer Fig.8-4
//Given
m=1.0;  //mass, kg
a_g=9.8;  //Acceleration due to gravity, m/s^2
q=4.0; //distance raised, m

//Computations
F=m*a_g; // Force, kg-m/s^2
E_k=F*q;   //Kinetic Energy, kg-m^2/s^2 (J)

printf("The kinetic energy, E_k = %.0f J.",E_k)
```

Scilab code Exa 8.7 `Ch8 Problem 7`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-7
//Refer Problem 8-6
//Given
m=1.0;  //mass, kg
a_g=9.8;  //Acceleration due to gravity, m/s^2
q=4.0; //distance lifted , m

//Computations
t=sqrt(2*q/a_g); ///time, s
v_inst= a_g*t; //in m/s
E_k=m*v_inst^2/2

printf("The kinetic energy is %.0f kg-m^2/s^2 (J).",
    E_k)
```

Scilab code Exa 8.8 `Ch8 Problem 8`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-8
//Given
m=200;  //mass, kg
a_g=9.8;  //Acceleration due to gravity, m/s^2
q=2.50; //distance lifted , m
t=7.00; //time, s

```

```
//Computations
P=m*a_g*q/t; //Power, W

printf("The power required, P = %.0f W.",P)
```

check Appendix ?? for dependency:

`Fig8_6.png`

Scilab code Exa 8.9 `Ch8 Problem 9`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 8-9
//Refer Problem 8-8 and Fig. 8-6
//Given
P_in=800;  //Wattmeter Power reading, W
P_out=700; //Power calculated in Problem 8-8, W

//Computations
Eff= (P_out/P_in)*100; //Efficiency in percent

printf("The Efficiency is %.1f percent.",Eff) //The
    result may vary due to round off/significant
    figures.
```

Chapter 9

Particles of Matter

Scilab code Exa 9.1 `Ch9 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9-1
//Theoretical Problem
```

Scilab code Exa 9.2 `Ch9 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9-2
//Theoretical Problem
```

Scilab code Exa 9.3 `Ch9 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9-3
//Theoretical Problem
```

Scilab code Exa 9.4 Ch9 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9-4
//Given
m_m=1.00; //mass of  matter, kg
m_am=1.00; //mass of anti-matter, kg
c=3.00*10^8; //speed of light, m/s^2

//Computations
m_left=m_m-m_am; //matter left, kg

if m_left>0
    printf("%.2f kg of matter is left over.\n", m_left)
end

if m_left<0
    printf("%.2f kg of anti-matter is left over.\n", -m_left)
end

if m_left==0
    printf("No matter or antimatter is left over.\n")
end

```

```
m=m_m+m_am-abs(m_left);   //in kg
E=m*c^2; //Einstein mass−energy formula, Energy in
    joules(J)

printf("The Energy, E = %.2E J.",E)
```

Scilab code Exa 9.5 Ch9 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9−5
//Refer Problem 9−4
//Given
P=100; //Power of the bulb, W
E=1.80*10^17;  //Energy calculated in Problem 9−4, J

//Computations
t_s=E/P; //time, s
t_yr=t_s/(60*60*24*365.25); //time, years


printf("The light bulb burns %.2E yr.",t_yr)
```

Scilab code Exa 9.6 Ch9 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 9−6
//Refer Problem 9−4
//Given
m_m=2.00; //mass of  matter, kg
```

```
m_am=1.00; //mass of anti-matter, kg
c=3.00*10^8; //speed of light, m/s^2

//Computations
m_left=m_m-m_am; //matter left, kg

if m_left>0
    printf("%.2f kg of matter is left over.\n",m_left)
end

if m_left<0
    printf("%.2f kg of anti-matter is left over.\n",-m_left)
end

if m_left==0
    printf("No matter or antimatter is left over.\n")
end

m=m_m+m_am-abs(m_left);  //mass of matter-antimatter interaction,in kg
E=m*c^2; //Einstein mass-energy formula, Energy in joules(J)

printf("The Energy liberated, E = %.2E J.",E)
```

Chapter 10

Basic States of Matter

Scilab code Exa 10.1 Ch10 Problem 1

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-1
//Given
v=45.3;  //volume, cm^3
m=0.543;  //mass, kg

//Computations
d=m*1000/v; //density, g/cm^3

printf("The density, d =  %.1f g/cm^3.",d)
```

Scilab code Exa 10.2 Ch10 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
```

```
//Problem 10-2
//Refer Problem 10-1
//Given
v=45.3;  //volume, cm^3
m=0.543;  //mass, kg

//Computations
d=m/(v*10^-6); //density, kg/m^3

printf("The density, d = %.2E kg/m^3.",d)
```

Scilab code Exa 10.3 `Ch10 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-3
//Given
l=1.00; //original length of cord, m
F1=5.00; //force, N
F2=2.00; //Force, N
l1=2.00; //length of cord when 5N force is applied,
   m

//Computations
s1=l1-l; //lengh stretched by 5N force, m
k=s1/F1;  //spring constant, m/N
s2=k*F2; //length stretched by 2N force, m
l2=l+s2; //length of cord when 2N force is applied,
   m

printf("The length of cord with 2N force applied is
   %.2f m.",l2)
```

Scilab code Exa 10.4 `Ch10 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-4
//Given
m=300; //mass, kg
v=0.275;  //volume, m^3

//Computations
d_m=m/v; //mass density, kg/m^3

printf("The mass density, d_m = %.0f kg/m^3.",d_m)
   //The answer vary due to round off error/
   significant figures.
```

Scilab code Exa 10.5 `Ch10 Problem 5`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-5
//Refer Problem 10-4
//Given
g=9.81; //in m/s^2
m=300; //in kg
v=0.275; //in m^3

//Computations
d_w=(m/v)*g; //weight density, N/m^3

```

```
printf("The weight density, d_w = %.2E N/m^3.",d_w)
```

Scilab code Exa 10.6 `Ch10 Problem 6`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-6
//Given
d_m=1000; //mass density of water, kg.m^3
a=10.000; //edge length of cube, cm
d=1.00; //depth of water, m

g=9.81; //in m/s^2

//Computations
F=(d_m*g*d)*(6*(a/100)^2); //Force, N

printf("The force on the cube, F = %.0f N.",F)
```

check Appendix ?? for dependency:

`Fig10_4.png`

Scilab code Exa 10.7 `Ch10 Problem 7`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 10-7
//Refer Fig. 10-4
//Given
A1=12.00;  //in cm^2
```

```
A2=15.00;   //in cm^2
F1=10.00;   //in N

//Computations
F2=F1*A2/A1;   //in N

printf("The upward force at piston number 2, F2 = %
   .2f N.", F2)
```

Chapter 11

Temperature Pressure and Changes of State

Scilab code Exa 11.1 `Ch11 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-1
//Given
m=3.00; //mass, g
E=5.0000; //energy supplied, cal
t=1.1234; //increase in temperature, degree C

//Computations
c=E/(m*t); //specific heat, cal/g/degree C

printf("The specific heat of the substance is %.2f
    cal/g/degree-Celsius.",c)
```

Scilab code Exa 11.2 `Ch11 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-2
//Given
F=72; //Temperature in degree Fahrenheit

//Computation
C=(5/9)*(F-32);

printf("The Celsius equivalent is %.0f degree-C.",C)
```

Scilab code Exa 11.3 `Ch11 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-3
//Given
F=80.0; //Temperature in degree Fahrenheit

//Computation
C=(5/9)*(F-32);
K=C+273.15;

printf("The Kelvin temperature equivalent is %.0f K.
    ",K)
```

Scilab code Exa 11.4 `Ch11 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
```

```
//Problem 11-4
//Given
d=10.000; //original length of rod, m
d1=10.025; //Increased length of rod, m
t=20.00;  //Initial temperature, degree Celsius
t1=25.00;  //Increased temperature, degree Celsius

//Computations
s=d1-d; //in m
T=t1-t;
alpha=s/(d*T);

printf("The thermal coefficient of linear expansion, alpha = %.1E /degree-Celsius",alpha)
```

Scilab code Exa 11.5 `Ch11 Problem 5`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-5
//Given
alpha=2.50*10^-4; // in /degree-C
V1=8.000; // in m^3
t1=30.0; //in degree-C
t2=20.0; // in degree-C

//Computations
d1=V1^(1/3); //Initial edge length, m
T=t2-t1;
s=alpha*d1*T;
d2=s+d1; //Final edge length, m
V2=d2^3; //in m^3

printf("The volume of the cube at %.1f degree-
```

```
Celsius is %.2f m^3.",t2,V2)
```

Scilab code Exa 11.6 Ch11 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-6
//Given
m=1.535; //mass, kg
h=142761; //in cal

//Computations
h_f=h/(m*1000); //in cal/g

printf("The heat of fusion of the material, h_f = %
    .2f cal/g.",h_f)
```

Scilab code Exa 11.7 Ch11 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 11-7
//Given
m=67.5; //mass, g
h_v=845; //heat of vaporization in cal/g

//Computations
h=h_v*m; //in cal

printf("The required heat, h = %.2E cal = %.1f kcal.
    ",h, h/1000)
```

Chapter 12

Direct Current

check Appendix ?? for dependency:

Fig12_8.png

Scilab code Exa 12.1 Ch12 Problem 1

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-1
//Refer Fig.12-8
//Given-
E=10;   //in V
R=10; //in ohm

//Computations
I=E/R; //in A

printf("The current , I = %.1f A.",I)
```

check Appendix ?? for dependency:

Fig12_8.png

Scilab code Exa 12.2 `Ch12 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-2
//Refer Fig.12-8
//Given
R=10.0; //Resistance, k-ohm
E=100; //in volts(V)

//Computations
I=E/(R*1000); // in A

printf("The current, I = %.4f A.",I)
```

check Appendix ?? for dependency:

`Fig12_8.png`

Scilab code Exa 12.3 `Ch12 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-3
//Refer Fig.12-8
//Given
R=100;  //in ohm
I=10.0; //in mA

//Computations
```

```
E=(I/1000)*R; //in V

printf("The dc voltage , E = %.2f V.",E)
```

check Appendix ?? for dependency:

Fig12_8.png

Scilab code Exa 12.4 Ch12 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-4
//Refer Fig.12-8
//Given
E=24;  // in V
I=3.0; // in A

//Computations
R=E/I; //in ohm

printf("The value of the potentiometer , R = %.1f
    ohms.",R)
```

check Appendix ?? for dependency:

Fig12_8.png

Scilab code Exa 12.5 Ch12 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
```

```
//Problem 12-5
//Refer Fig.12-8
//Given
E=12;   // in V
I=50; // in mA

//Computations
P=E*I/1000; //in W

printf("The power dissipated by potentiometer , P = %
    .2 f W.",P)
```

check Appendix ?? for dependency:

Fig12_9.png

Scilab code Exa 12.6 Ch12 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-6
//Refer Fig.12-9
///Given
R1=112; //in ohm
R2=470; //in ohm
R3=680; //in ohm

//Computations
R=R1+R2+R3; //in ohm

printf("The total resistance of the series
    combination is %.0f ohms.",R) //The answer may
    vary due to round-off errors/significant figures.
```

check Appendix ?? for dependency:

Fig12_10.png

Scilab code Exa 12.7 Ch12 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-7
//Refer Fig.12-10
///Given
R1=100; //in ohm
R2=200; //in ohm
R3=300; //in ohm
R4=400; //in ohm
R5=500; //in ohm

//Computations
R=1/((1/R1)+(1/R2)+(1/R3)+(1/R4)+(1/R5)); //in ohm

printf("The total resistance of the parallel
    combination, R = %.1f ohms.",R)
```

check Appendix ?? for dependency:

Fig12_11.png

Scilab code Exa 12.8 Ch12 Problem 8

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-8
//Refer Fig. 12-11
```

```
//Given
R_n1=10; //value of resistance for five resistors, ohms
R_n2=20; //value of resistance for other five resistors, ohms
E=15; //in V

//Computations
R=R_n1*5+R_n2*5; //ohms
I=E/R; //in A
E_1=I*R_n1; //voltage across one 10 ohm resistors, V
E_2=I*R_n2; //voltage across one 20 ohm resistors, V

printf("The voltage across one of the 10-ohm resistors = %.1f V.\n",E_1)
printf("The voltage across one of the 20-ohm resistors = %.1f V.",E_2)
```

check Appendix ?? for dependency:

Fig12_12.png

Scilab code Exa 12.9 Ch12 Problem 9

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-9
//Refer Fig. 12-12
//Given
E=12; // in V
R_n=120; //value of each resistors, ohms
n=12; //number of resistors

//Computations
R=R_n/n; //in ohms
```

```
I=E/R; //in A

printf("The total current drawn from the battery, I
   = %.1f A.",I)
```

Scilab code Exa 12.10 Ch12 Problem 10

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-10
//Refer Problem 12-9
//Given
E=12; // in V
R_n=120; //value of each resistors, ohms
n=12; //number of resistors

//Computations
I_n=E/R_n; //in A

printf("The ammeter reading, I_n = %.2f A.",I_n)
```

Scilab code Exa 12.11 Ch12 Problem 11

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-11
//Given
E=150; //supply voltage, V
R1=330; //in ohm
R2=680; //in ohm
R3=910; //in ohm
```

```
//Computations
R=R1+R2+R3; //Total resistance of the series
    combination , ohms
I=E/R;
P2=I^2*R2; //in W

printf("The power dissipated by R2, P2 = %.2f W.",P2
    )
```

Scilab code Exa 12.12 `Ch12 Problem 12`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-12
//Given
E=3.0; //supply voltage , V
R1=22; //in ohm
R2=47; //in ohm
R3=68; //in ohm

//Computations
P1=E^2/R1; //in W
P2=E^2/R2; //in W
P3=E^2/R3; //in W

printf("The power dissipated by R1, P1 = %.2f W.\n",
    P1)
printf("The power dissipated by R2, P2 = %.2f W.\n",
    P2)
printf("The power dissipated by R3, P2 = %.2f W.",P3
    )
```

check Appendix ?? for dependency:

Fig12_13.png

Scilab code Exa 12.13 Ch12 Problem 13

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-13
//Refer Fig. 12-13
//Given
R_b=100; //Value of resistance for resistors below Z, ohms
R_a=10.0; //Value of resistance for resistors above Z, ohms
I_100=500; //Current trough each 100-ohm resistor, mA

//Computations
I1=I_100;
I2=I_100;
I_10=(I1+I2)/3; //Current though any one of 10-ohm resistor, mA
E=(I_10/1000)*R_a; //Voltage across any one of 10-ohm resistor, V

printf("The current through any of the 10-ohm resistors = %.0f mA.\n",I_10)
printf("The voltage across any of the 10-ohm resistors = %.2f V.",E)
```

check Appendix ?? for dependency:

Fig12_14.png

Scilab code Exa 12.14 `Ch12 Problem 14`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 12-14
//Refer Fig. 12-14
//Given
R1=50; //ohms
R2=60; //ohms
R3=70; //ohms
R4=80; //ohms
I=500; //mA

//Computations
E1=I*R1/1000; //V
E2=I*R2/1000; //V
E3=I*R3/1000; //V
E4=I*R4/1000; //V
E=E1+E2+E3+E4; //V

printf("The supply voltage, E = %.0f V.",E)
```

Chapter 13

Alternating Current

Scilab code Exa 13.1 `Ch13 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-1
//Given
T=5.000*10^-6; //period of the wave, s

//Computations
f_Hz=1/T; //frequency in Hz
f_kHz=f_Hz/10^3; //frequency, kHz
f_MHz=f_kHz/10^3; //frequency, MHz

printf("The frequency in hertz, f_Hz = %.3E Hz.\n",
    f_Hz)
printf("The frequency in kilohertz, f_kHz = %.1f kHz
    .\n",f_kHz)
printf("The frequency in megahertz, f_MHz = %.4f MHz
    .\n",f_MHz)
```

check Appendix ?? for dependency:

`Fig13_5.png`

Scilab code Exa 13.2 Ch13 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
///Problem 13-2
//Refer Fig. 13-5
//Given
T_axis=1.0; //measure of each division on Time(
    horizontal) axis, microseconds

//Computations
//From the graph
T_div=4; //Number of horizontal(Time-axis) divisions
    for time period of the wave
T=T_axis*T_div*10^-6;  //Time peroid, s
f=1/T; //frequency, Hz

printf("The period of the triangular wave, T = %.1f
    microseconds or %.1E s.\n",T*10^6,T)
printf("The frequency, f = %.1E Hz.",f)
```

Scilab code Exa 13.3 Ch13 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-3
//Given
f=60.0; //frequency, Hz

//Computations
```

```
omega= 2*%pi*f; //angular frequency , rad/s

printf("The angular frequency , omega = %.0f rad/s.",
    omega)
```

Scilab code Exa 13.4 Ch13 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-4
//Given
omega=3.8865*10^5; //angular frequency , rad/s

//Computations
f_Hz=omega/(2*%pi);
f_kHz=f_Hz/10^3;

printf("The frequency in kilohertz , f_kHz = %.1f kHz
    .",f_kHz)
```

Scilab code Exa 13.5 Ch13 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-5
//Given
V_pk_pk=60; //peak to peak value of the wave, V

//Computations
V_pk=V_pk_pk/2; //peak voltage , V

```

```
printf("The peak voltage is %.0f V pk.\nHalf the
   peaks are +%d V; half are %d V.",V_pk,V_pk,-V_pk)
```

Scilab code Exa 13.6 Ch13 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-6
//Refer Problem 13-5
//Given
V_pk_pk=60; //peak to peak value of the wave, V
V_dc=10; //dc component of the wave, V

//Computations
V_ppk= V_pk_pk/2+V_dc; //positive peak voltage, V
V_npk= -V_pk_pk/2+V_dc; //negative peak value, V

if V_dc~=0
    printf("The absolute peak value cannot be
       determined.\n")
end

printf("The positive peak voltage is %.0f V.\n",
   V_ppk)
printf("The negative peak voltage is %.0f V.",V_npk)
```

Scilab code Exa 13.7 Ch13 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-7
```

```
//Given
phi_XY_rad=0.5000; //angle by which wave X leads wave Y, rad
cycle_YZ=1/8;  //part of cycle by which wave Y leads wave Z

//data used
rad2deg=57.296; //for conversion from radian to degrees

//Computations
phi_XY_deg=phi_XY_rad*rad2deg; //in degrees
phi_YZ=cycle_YZ*360; //in degrees
phi_XZ=phi_XY_deg+phi_YZ; //angle by which wave X leads wave Z, degrees

if phi_XZ>=0
    printf("Wave X leads wave Z by %.2f degrees.",phi_XZ)
end

if phi_XZ<0
    printf("Wave X lags wave Z by %.2f degrees.",-phi_XZ)
end
```

Scilab code Exa 13.8 `Ch13 Problem 8`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 13-8
//Given
phi_XY_rad=0.5000; //angle by which wave X leads wave Y, rad
```

```
cycle_YZ=1/8;  //part of cycle by which wave Y lags wave Z

//data used
rad2deg=57.296; //for conversion from radian to degrees

//Computations
phi_XY_deg=phi_XY_rad*rad2deg; //in degrees
phi_YZ=cycle_YZ*360; //in degrees
phi_XZ=phi_XY_deg-phi_YZ; //angle by which wave X leads wave Z, degrees

if phi_XZ>=0
    printf("Wave X leads wave Z by %.2f degrees.",phi_XZ)
end

if phi_XZ<0
    printf("Wave X lags wave Z by %.2f degrees.",-phi_XZ)
end
```

Chapter 14

Magnetism

Scilab code Exa 14.1 `Ch14 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 14-1
//Given
r=20; //in cm
I=400; // in mA

//Computations
B=2*10^-7*(I/1000)/(r/100); //in tesla(T)

printf("The flux density , B = %.1E T.",B)
```

Scilab code Exa 14.2 `Ch14 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
```

```
//Problem 14-2
//Refer Example 14-1
//Given
r=20; //in cm
I=400; // in mA

//Computations
B=2*10^-7*(I/1000)/(r/100); //in tesla(T)
B_gauss=B*10^4; // in G

printf("The flux density, B_gauss = %.1E G.",B_gauss
    )
```

Scilab code Exa 14.3 Ch14 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 14-3
//Theoretical Problem - involves no computations
```

Scilab code Exa 14.4 Ch14 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 14-4
//Given
B_c=0.500; //magnetic flux with current, T
B_nc=500; //magnetic flux with no current, G

//Computations
B_r=B_nc/(B_c*10^4)*100; //retentivity, in percent
```

```
printf("The retentivity of the core material, B_r = %.1f percent.",B_r)
```

Scilab code Exa 14.5 Ch14 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 14-5
//Given
s=20; //length of wire, cm
n=100; //number of turns
B=20; //flux density, G
mu=100; //permeability of core material

//Computations
I=(1/(4*%pi*10^-7)) * (s/100)*(B/10^4)/(mu*n) *1000;
    //in mA

printf("The current in wire, I = %.0f mA.",I)
```

Chapter 15

More About Alternating Current

Scilab code Exa 15.1 Ch15 Problem 1

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-1
//Given
L1=1.50; // in mH
L2=150; // in micro H
L3=120; //in micro H

//Computations
 //for series combination of the inductors, net
    inductance is,
L_s=L1+L2*10^-3+L3*10^-3; // in mH

printf("The net series inductance, L_s = %.2f mH.",
   L_s)
```

Scilab code Exa 15.2 Ch15 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-2
//Refer Problem 15-1
//Given
L1=1.50; // in mH
L2=150; // in micro H
L3=120; //in micro H

//Computations
L_p=1/((1/(L1*1000))+(1/L2)+(1/L3)); // net parallel
    inductance in microhenry

printf("The net parallel inductance, L_p = %.1f muH(
    microhenrys).", L_p)
```

Scilab code Exa 15.3 Ch15 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-3
//Given
L=10.0; //in mH
f=100; // in kHz

//Computations
x_L=2*%pi*(f*1000)*(L/1000); // reactance, ohms

printf("The reactance, x_L = %.0f ohms or %.2f kilo-
    ohms.",x_L, x_L/1000)    //The answer may vary due
     to round-off errors/significant figures.
```

Scilab code Exa 15.4 `Ch15 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15−4
//Given
C1=0.10; // in muF
C2=0.050; // in muF

//Computations
C=1/((1/C1)+(1/C2)); // in muF

printf("The total capacitance, C = %.3f muF (
   microfarads).",C)
```

Scilab code Exa 15.5 `Ch15 Problem 5`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15−5
//Given
C1=0.0010; // in muF
C2=100; // in pF

//Computations
C=1/((1/C1)+(1/(C2*10^-6))); // in muF

printf("The total capacitance, C = %.6f muF (
   microfarads) or %.0f pF.",C,C*10^6)
```

Scilab code Exa 15.6 `Ch15 Problem 6`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-6
//Given
C1=0.100; // in muF
C2=0.0100; //in muF
C3=0.00100; // in muF

//Computations
C=C1+C2+C3; //Total parallel capacitance, muF

printf("The total capacitance, C = %.3f muF (
   microfarads).",C)
```

Scilab code Exa 15.7 `Ch15 Problem 7`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-7
//Given
C=0.00100; // Capacitance in muF
f=1.00; //frequency in MHz

//Computations
X_C=-1/(2*%pi*f*10^6*C*10^-6); // in ohms

if isinf(X_C)==%F
```

```
    printf("The capacitive reactance, X_C = %.0f
       ohms.",X_C)
end

if isinf(X_C)==%T
    printf("The capacitance is extremely large
       negative i.e. negative infinity. \n The
       capacitor is an open circuit.")
end
```

Scilab code Exa 15.8 Ch15 Problem 8

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-8
//Refer Problem 15-7
//Given
C=0.00100; // Capacitance in muF
f=0; //frequency

//Computations
X_C=-1/(2*%pi*f*10^6*C*10^-6); // in ohms

if isinf(X_C)==%F
    printf("The capacitive reactance, X_C = %.0f
       ohms.",X_C)
end

if isinf(X_C)==%T
    printf("The capacitance is extremely large
       negative i.e. negative infinity. \n The
       capacitor is an open circuit.")
end
```

Scilab code Exa 15.9 Ch15 Problem 9

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-9
//Given
X_C=-100; //capacitor's reactance, ohms
f=10.0; //frequency, MHz

//Computations
C=-1/(2*%pi*f*X_C); //in muF

printf("The capacitance, C = %.6f muF(microfarads) =
    %.0f pF.",C,C*10^6)
```

Scilab code Exa 15.10 Ch15 Problem 10

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 15-10
//7 Complex Impedances with absolute value of 10-
   ohms are to be named

//Computations
printf("Seven complex impedances with absolute value
    of Z=10 ohms are :- \n")
n=0; //no of complex impedances found/displayed
    for i=0:10
        for j=0:10
```

```
            if (abs(complex(i,j))==10 && (i==0 || j==0) && n<7) //condition on i and j is imposed to avoid printing 10-j0 as 10+j0 is same as this,
                printf("%d.  %d + j%d\n",n+1,i,j); n=n+1;
                printf("%d.  %d + j%d\n",n+1,j,i); n=n+1;
                printf("%d.  %d - j%d\n",n+1,i,j); n=n+1;
              end
            if (abs(complex(i,j))==10 && (i~=0 && j~=0) && n<7)
                printf("%d.  %d + j%d\n",n+1,i,j); n=n+1;
                printf("%d.  %d - j%d\n",n+1,i,j); n=n+1;
                printf("%d.  %d + j%d\n",n+1,j,i); n=n+1;
                printf("%d.  %d - j%d\n",n+1,j,i); n=n+1;
                end
              end
            end
```

Chapter 16

Semiconductors

Scilab code Exa 16.1 Ch16 Problem 1

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 16-1
//Given
V=13.8; //Total voltage of the solar battery, V

//Data assumed
v=0.6; //Voltage produced by each silicon PV cell, V

//Computations
n=V/v;

printf("In order to get %.1f V dc from solar battery
    , we must connect %d of PV cells in series.",V,n)
```

Scilab code Exa 16.2 Ch16 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 16-2
//Given
I_g=23.5; //current gain at ideal condition
f=1000; //operating frequency, Hz
f_alpha=900; //alpha cutoff, kHz

//Computations
I_gm=I_g*0.707; //maximum possible current gain at
    900 kHz

printf("The maximum possible current gain that the
    transistor can produce at %d kHz is %.1f.",
    f_alpha,I_gm)
```

Scilab code Exa 16.3 `Ch16 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 16-3
//Refer Problem 16-2
//Given
I_g=23.5; //current gain at ideal condition
f=1000; //operating frequency, Hz
f_alpha=900; //alpha cutoff, kHz
I_i=2.00; //peak to peak signal input current, mA

//Computations
I_o=I_i*I_g*0.707; //peak to peak output signal
    current at 900 kHz, mA

printf("The pk-pk output signal current is %.1f mA."
```

```
,I_o) // The unit in book answer is mistakenly
written as muA (microamperes).
```

Scilab code Exa 16.4 Ch16 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 16-4
//Theoretical Problem - involves no computation.
```

Chapter 17

Wave Phenomena

check Appendix **??** for dependency:

`Fig17_1.png`

Scilab code Exa 17.1 `Ch17 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-1
//Refer Fig.17-1
//Given
  //For One revolution per second
  T1=1; //time period , s

  //For one revolutions per 2 second
  T2=2; //time period , s

//Computations
f1=1/T1; //frequency , Hz
f2=1/T2; //frequency , Hz
f2_by_f1=f2/f1; //frequency ratio
lambda2_by_lambda1=1/f2_by_f1; //wavelength ratio
```

```
printf("The wavelength becomes %d times as long.",
    lambda2_by_lambda1)
```

Scilab code Exa 17.2 Ch17 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-2
//Given
lambda_1=500; //wavelength in first medium, nm
c_2=2.00*10^8; //speed of light in second medium, m/
    s

//Data assumed
C_1=3.0*10^8; //speed of light in first medium. m/s

//Computations
 //As frequency does not change,
 lambda_2=(c_2/C_1)*lambda_1; // wavelength in
    second medium, nm

 printf("The wavelength in new medium is %d nm.",
    lambda_2)
```

Scilab code Exa 17.3 Ch17 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-3
```

```
//Degrees of phase between standing wave loop and adjacent node is to be found

//Computations
n_loops=2; //number of loops in standing-wave complete cycle
n_nodes=2; //number of nodes in standing-wave complete cycle
phi_cycle=360; //phase in a complete cycle, degrees

phi=phi_cycle/(n_loops+n_nodes); //phase between loop and node, degrees

printf("A standing-wave loop is %d degrees from adjacent node.",phi)
```

Scilab code Exa 17.4 `Ch17 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-4
//Given
f=500; // in Hz
g=2.500; // in kHz

//Computations
x=g*1000-f; //in Hz
y=g*1000+f;  //in Hz

printf("The beat frequencies are:-\n x=%d Hz = %.2f kHz.\n y=%d Hz = %.2f kHz.",x,x/1000,y,y/1000)
```

Scilab code Exa 17.5 Ch17 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-5
//Given
lambda=550; //wavelength , nm

//data assumed
h=6.6262*10^-34 //value of Planck's constant ,J-s
c=2.99792*10^8; //speed of light , m/s

//Computations
e=h*c/(lambda*10^-9); //energy , J

printf("The energy contained in the photon , e = %.2E
    J.",e)
```

Scilab code Exa 17.6 Ch17 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 17-6
//Given
e=1.000*10^-25; //energy , J

//data assumed
h=6.6262*10^-34 //value of Planck's constant ,J-s
c=2.99792*10^8; //speed of light , m/s

//Computations
lambda=h*c/e; //wavelength , m

```

```
printf("The wavelength of the EM, lambda = %.4f m.",
   lambda)
```

Chapter 18

Forms of Radiation

Scilab code Exa 18.1 Ch18 Problem 1

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-1
//Given
lambda=7400; //wavelength , angstron

//Computations
  //As f=c/lambda, c being speed of light =
     2.99792*10^8 m/s
f=2.99792*10^8/(7400*10^-10); // frequency , Hz

printf("The frequency of the red laser beam, f = %.3
   E Hz = %.1f THz.", f,f/10^12)
```

Scilab code Exa 18.2 Ch18 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
```

```
clc;
clear;
//Problem 18-2
//Given
f=60.0000; //frequency, Hz

//Computations
 //using lambda- = c/f
lambda=2.99792*10^8/f; // wavelength, m

printf("The wavelength of the EM field produced in
    free space by ac in a common utility line is %.5E
    m.",lambda)
```

Scilab code Exa 18.3 Ch18 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-3
//Theoretical Problem
```

Scilab code Exa 18.4 Ch18 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-4
//Given
lambda=0.00100; //wavelength, nm

//Data assumed
h=6.62607*10^-34; //Planck's constant, J-s
```

```
c=2.99792*10^8; //speed of light , m/s

//Computations
e=h*c/(lambda*10^-9); //energy , J

printf("The energy contained in each photon of the
    gamma rays , e=%.2E J.",e)
```

Scilab code Exa 18.5 Ch18 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-5
//Given
t_half=100; //half-life , days
t=365; //time for which intensity is to be found ,
    days

//Computations
n=t/t_half; //number of half-lives elapsed
x_365_by_x_0=(1/2)^n;  //x_365/x_0

printf("The intensity after 365 days, x_365 = %.4f
    x_0.",x_365_by_x_0)
```

Scilab code Exa 18.6 Ch18 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-6
//Refer Problem 18-5
```

```
//Given
t_half=100; //half-life, days

//Computations
lambda=0.69315/(t_half*24*60*60); //decay constant,
    per sec

printf("The decay constant, lambda = %.2E s^-1.",
    lambda)
```

Scilab code Exa 18.7 Ch18 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 18-7
//Refer Problem 18-5
//Given
t_half=100; //half-life, days

//Computations
tau=t_half/0.69315; //mean life, days

printf("The mean life of the substance, tau = %.2E s
    = approx. %d days.",tau*24*60*60,ceil(tau))
```

Chapter 19

Optics

Scilab code Exa 19.1 `Ch19 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-1
//Given
r_m=1.50; //refractive index of the medium

//Data assumed
c=3.00*10^5; //speed of light in vaccum, km/s

//Computations
c_m=c/r_m; //speed of light in medium, km/s

printf("The speed of yellow light in the medium, c_m
    = %.2E km/s.",c_m)
```

Scilab code Exa 19.2 `Ch19 Problem 2`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-2
//Given
r=1.33; //refractive index of water
s=1.00; //refractive index of air
x=30.0; //angle of incidence, in degrees

//Computations
y=asind(sind(x)*r/s); //angle of emergance, degrees

printf("The beam will emerge at an angle y=%.1f
    degrees, relative to normal, into the air.",y)
```

Scilab code Exa 19.3 `Ch19 Problem 3`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-3
//Refer Problem 19-2
//Given
r=1.33; //refractive index of water
s=1.00; //refractive index of air

//Computations
x_c=asind(s/r); //critical angle, degrees

printf("The critical angle, x_c = %.1f degrees.",x_c
    )
```

Scilab code Exa 19.4 `Ch19 Problem 4`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-4
//Theoretical Problem
```

Scilab code Exa 19.5 Ch19 Problem 5

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-5
//Given
D=15.0; //diameter of objective of larger telescope,
    cm
d=6.00; //diameter of obective of smaller telescope,
    cm

//Computations
k=D/d; //ratio of objective's diameters

printf("The larger telescope gathers %.2f times, or
   %d percent as much light as the smaller one.",k
   ^2, k^2*100)
```

Scilab code Exa 19.6 Ch19 Problem 6

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-6
//Given
m=100; //magnification
```

```
f_e=20.0; //focal length of eye piece, mm

//Computations
f_o=m*f_e; //in mm

printf("The focal length of the objective, f_o = %d mm = %.2f m.",f_o, f_o/1000) //The answer given in book in mm is wrong. It should be 2,000 instead of 1,000.
```

Scilab code Exa 19.7 Ch19 Problem 7

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-7
//Refer Problem 19-6
q20=20; //absolute field view with 20-mm eyepiece in arc minutes
f_e1=20; //initial eye-piece focal length, mm
f_e2=10; //replaced eye-piece focal length, mm

//Computations
 //As magnification, m = f_o / f_e, magnification is inversely proportional to f_e. Let m10 and m20 denotes the magnification with 10-mm and 20-mm eye-piece respectively. Then,
m10_by_m20=f_e1/f_e2; // ratio of magnification
//for same viewing angle,field of view is inversely proportional to magnification
q10=(1/m10_by_m20)*q20; //absolute field view eith 10-mm eye-piece, arc minutes

printf("The absolute field of view of the telescope using the %d-mm eyepiece is %.1f time as wide or
```

```
    %d arc minutes.",f_e2,1/m10_by_m20,q10)
```

Scilab code Exa 19.8 Ch19 Problem 8

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 19-8
//Given
m_o=10; //magnification of objective lens
m_e=5; //magnification of eye-piece

//Computations
m=m_o*m_e;

printf("The power of the instrument, m = %dX (times)
    .",m)
```

Chapter 20

Relativity Theory

Scilab code Exa 20.1 `Ch20 Problem 1`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 20-1

//Data assumed
c=3.00*10^5; //speed of radio signals , km/s
d=4.0*10^5; //the distance between earth and moon,
    km

//Computations
t=d/c; //time taken by radio signal to travel from
    earth to moon, light-seconds

printf("The clock M will be shifted approx. %.1f s
    ahead in time. \nThe clock E will be shifted %.1f
     s behind in time. \nWhen you get to the Moon,
    clock M will be approx. %.1f s ahead of clock E."
    , t,t,2*t)   //The answer may vary due to round-
    off errors.
```

Scilab code Exa 20.2 Ch20 Problem 2

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 20-2
//Theoretical Problem
```

Scilab code Exa 20.3 Ch20 Problem 3

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 20-3
//Given
k=2.00; //time-dilation factor

//data assumed
c=2.99792*10^8; //speed of light, m/s

//Computations
u=sqrt(1-1/k^2);
speed=u*c; //speed required, m/s

printf("The necessary speed is %.1f percent of speed
    of light, or %.2E m/s.",u*100, speed)
```

Scilab code Exa 20.4 Ch20 Problem 4

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 20-4
//Given
speed=2.40*10^8; //speed of ship, m/s
l=19.5; //at-rest length of ship, m

//data used
c=3.00*10^8; //speed of light, m/s

//Computations
u=speed/c;
L=sqrt(1-u^2); //apparent length of the ship as fraction of its length
L_app=l*L; //apparent length of moving ship, m

printf("The ship will look %.1f m long when it whizzes by at %.2E m/s.",L_app,speed)
```

Scilab code Exa 20.5 `Ch20 Problem 5`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
clc;
clear;
//Problem 20-5
//Given
mass=300; //mass of meteoroid, mg
u_percent=99.9; //speed of space vessel as percentage of speed of light.

//Computations
u=u_percent/100;
m=1/sqrt(1-u^2);
m_app=m*mass; //apparent mass of meteoroid, mg
```

```
printf("The apparent mass of the meteoroid when it strikes the vessel is %.2f grams(g).",m_app/1000) //The answer may vary due to round-off errors.
```

Appendix

Scilab code AP 15 `QuadPointsPlot`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
//Function to Find Points and plot the graph of a Quadratic Equation.
/* Caution:- To be executed before GraphSolveQL.sci is executed*/
//The function is used in Example A, Page 55 and Example B, Page 56 of Chapter 3.
clear;
function QuadPointsPlot(A,B,C,f,gRect,gWindow)
  // A,B,C are coefficients in the equation given and f is the function defined for the equation.
  // gRect is range for axis on Graph and gWindow is graphic window number.
    x_0=-B/(2*A);
    y_0=C-B^2/(4*A);
    printf("The known points are:-\n ")
    printf("(x_0 , y_0 ) = (%d,%d)\n ",x_0,y_0)
    printf("(x_-2,y_-2) = (%d,%d)\n ",x_0-2,f(x_0-2))
    printf("(x_-1,y_-1) = (%d,%d)\n ",x_0-1,f(x_0-1))
    printf("(x_1 , y_1 ) = (%d,%d)\n ",x_0+1,f(x_0+1))
    printf("(x_2 , y_2 ) = (%d,%d)\n",x_0+2,f(x_0+2))
  x=[x_0-2, x_0-1, x_0, x_0+1, x_0+2];
  y=[f(x_0-2), f(x_0-1), f(x_0), f(x_0+1), f(x_0+2)]

```

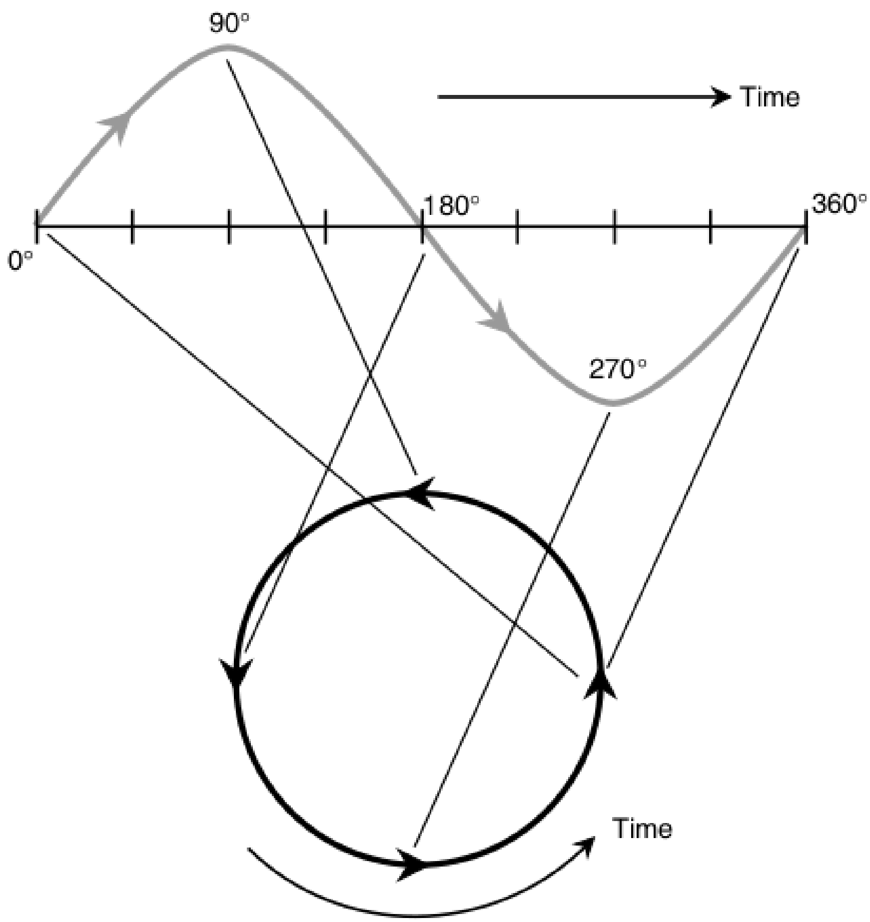


Fig. 17-1. Graphic representation of a sine wave as circular motion.

Fig.17-1

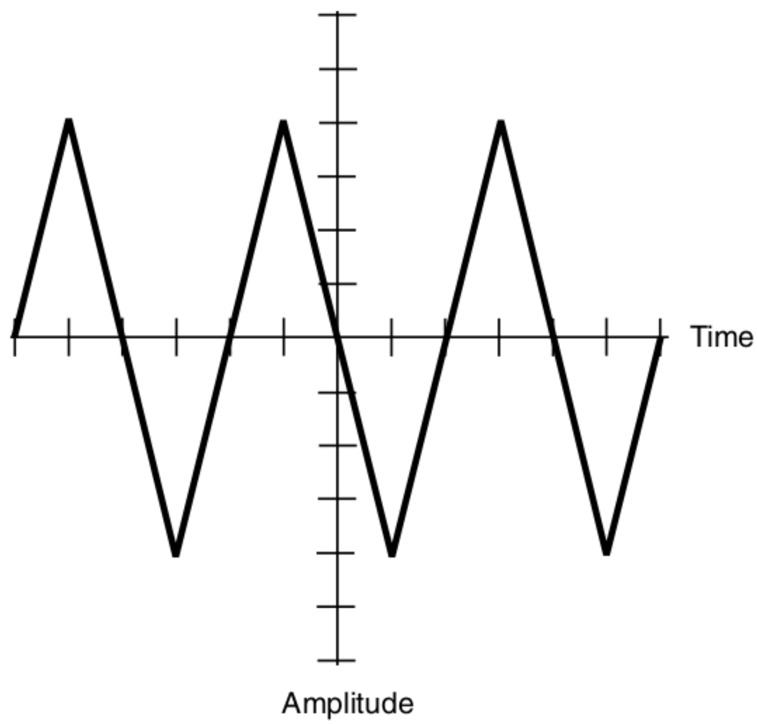


Fig. 13-5. A triangular wave.

Fig.13-5

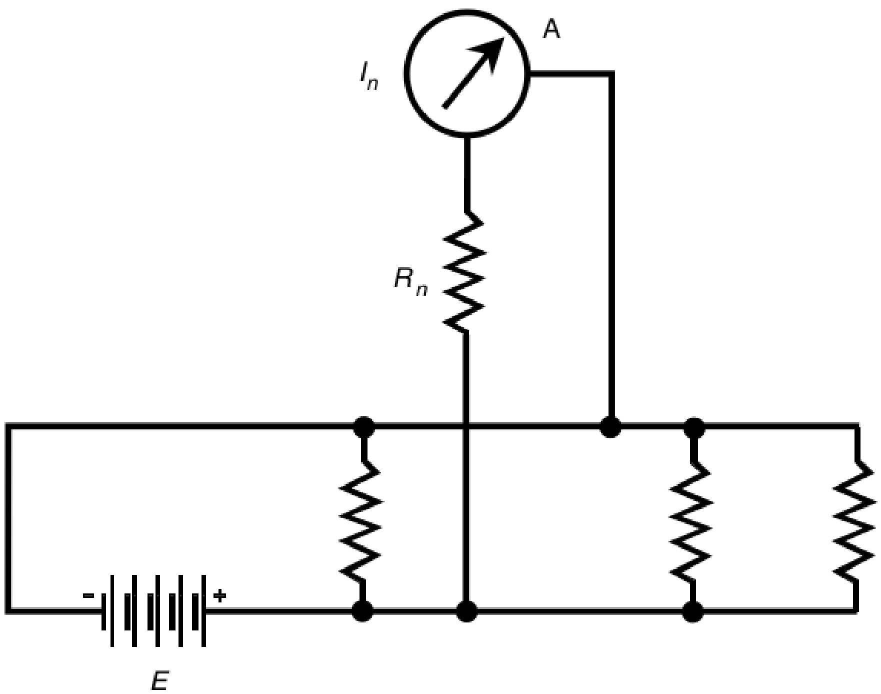


Fig. 12-12. Analysis of current in a parallel dc circuit. See text for discussion.

Fig.12-12

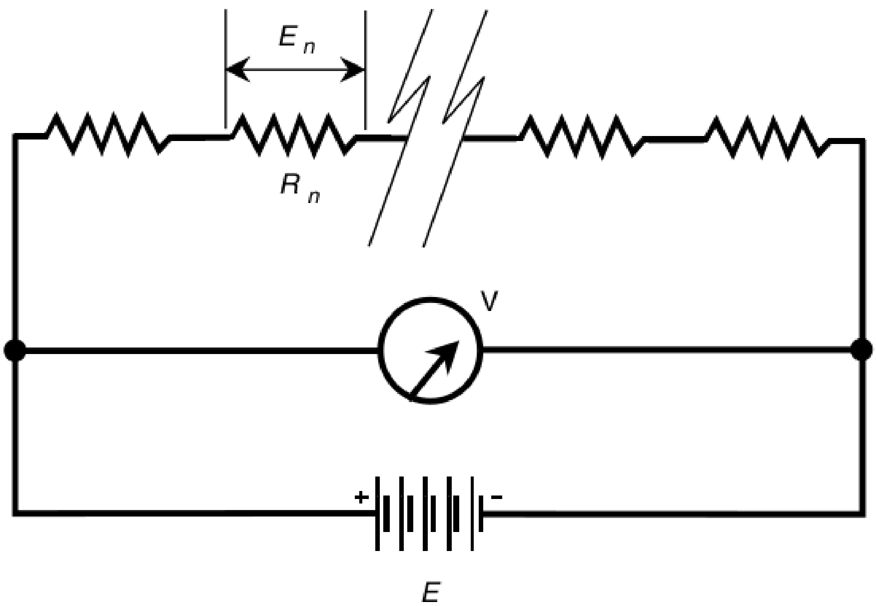


Fig. 12-11. Analysis of voltage in a series dc circuit. See text for discussion.

Fig.12-11

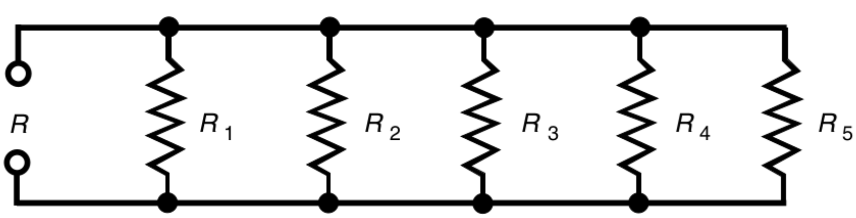


Fig. 12-10. Five general resistances in parallel.

Fig.12-10

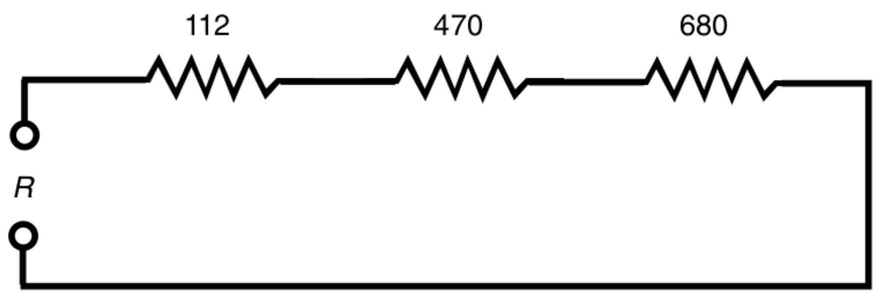


Fig. 12-9. An example of three specific resistances in series.

Fig.12-9

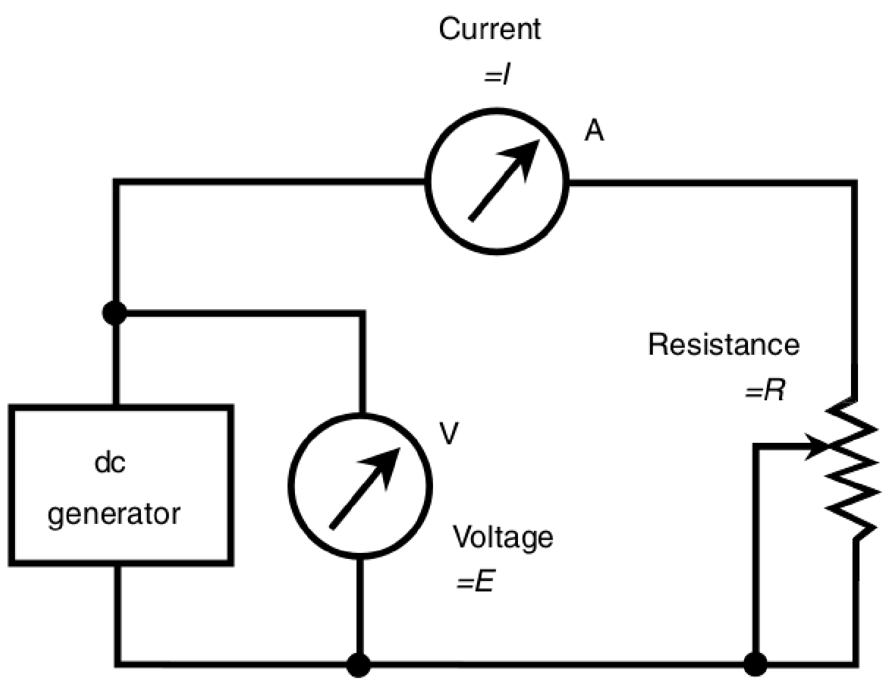


Fig. 12-8. Circuit for working Ohm's law problems.

Fig.12-8

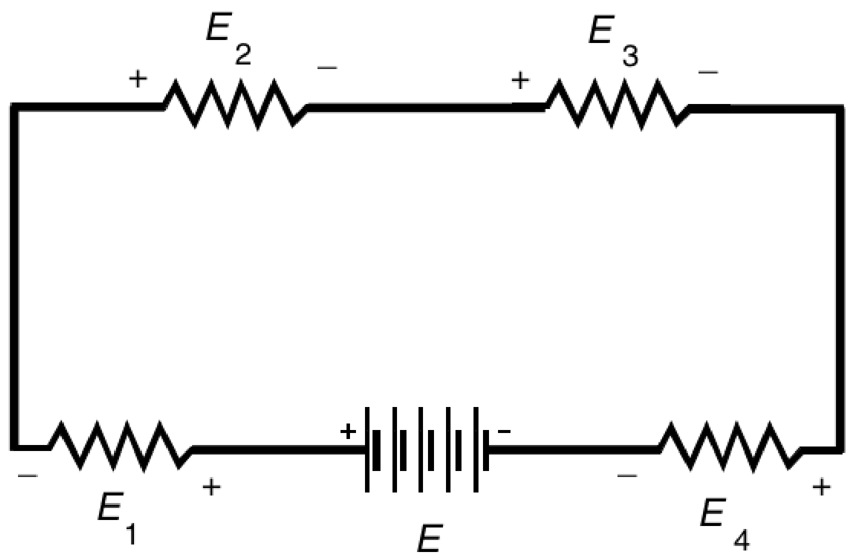


Fig. 12-14. Kirchhoff's voltage law. The sum of the voltages $E + E_1 + E_2 + E_3 + E_4 = 0$, taking polarity into account.

Fig.12-14

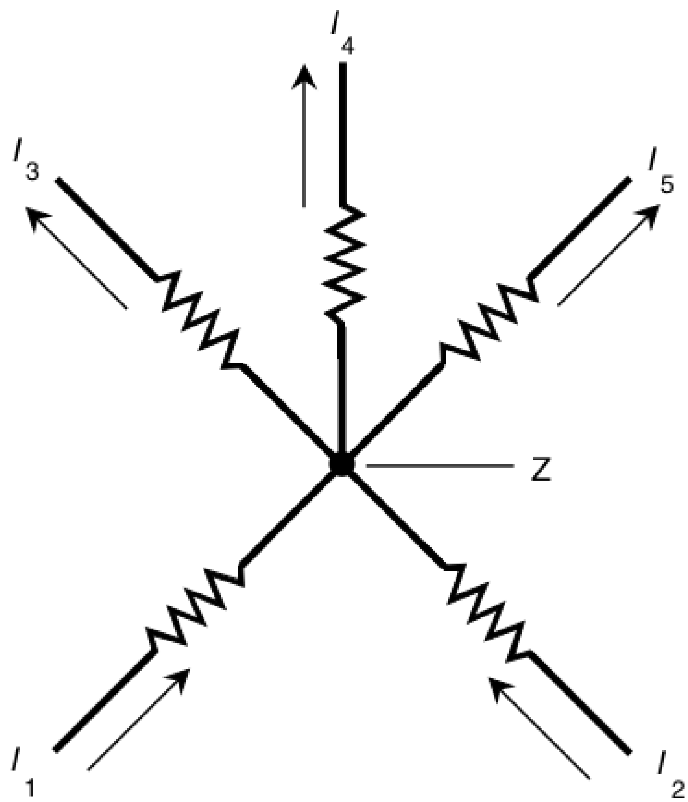


Fig. 12-13. Kirchhoff's current law. The current entering point Z is equal to the current leaving point Z. In this case, $I_1 + I_2 = I_3 + I_4 + I_5$.

Fig.12-13

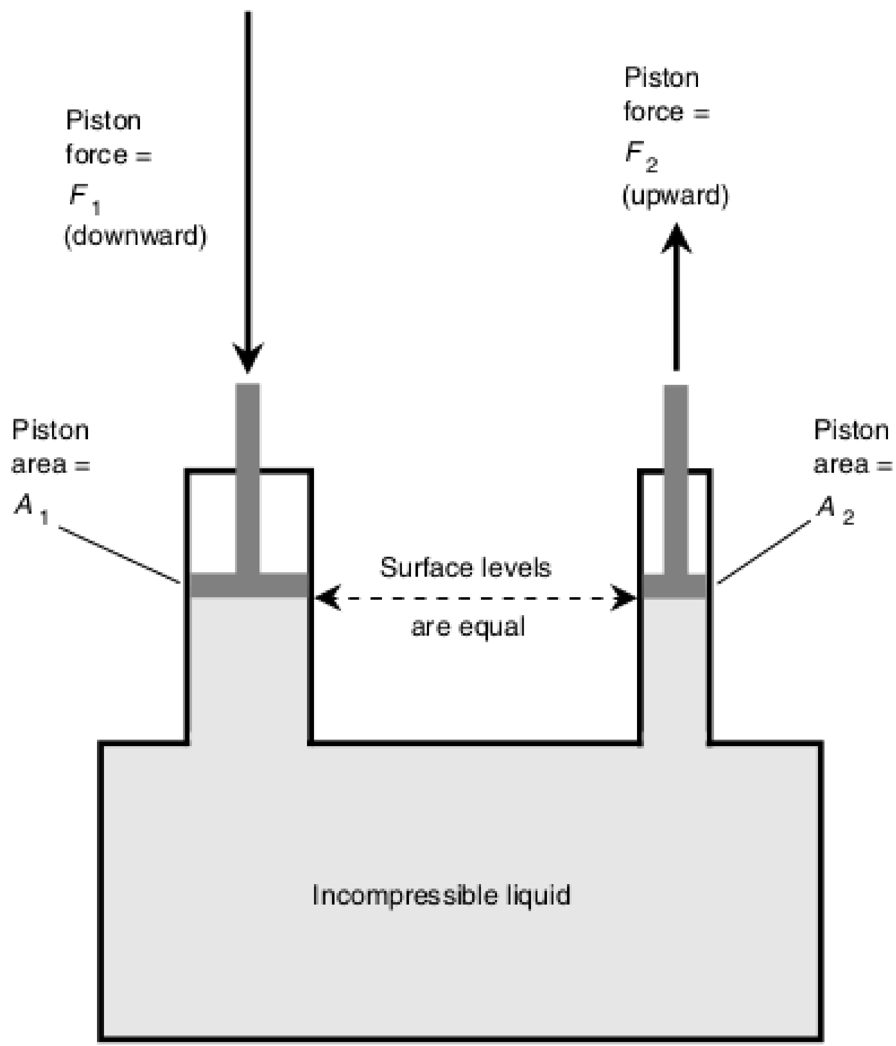


Fig. 10-4. Pascal's law for confined, incompressible liquids. The forces are directly proportional to the areas of the pistons.

Fig.10-4

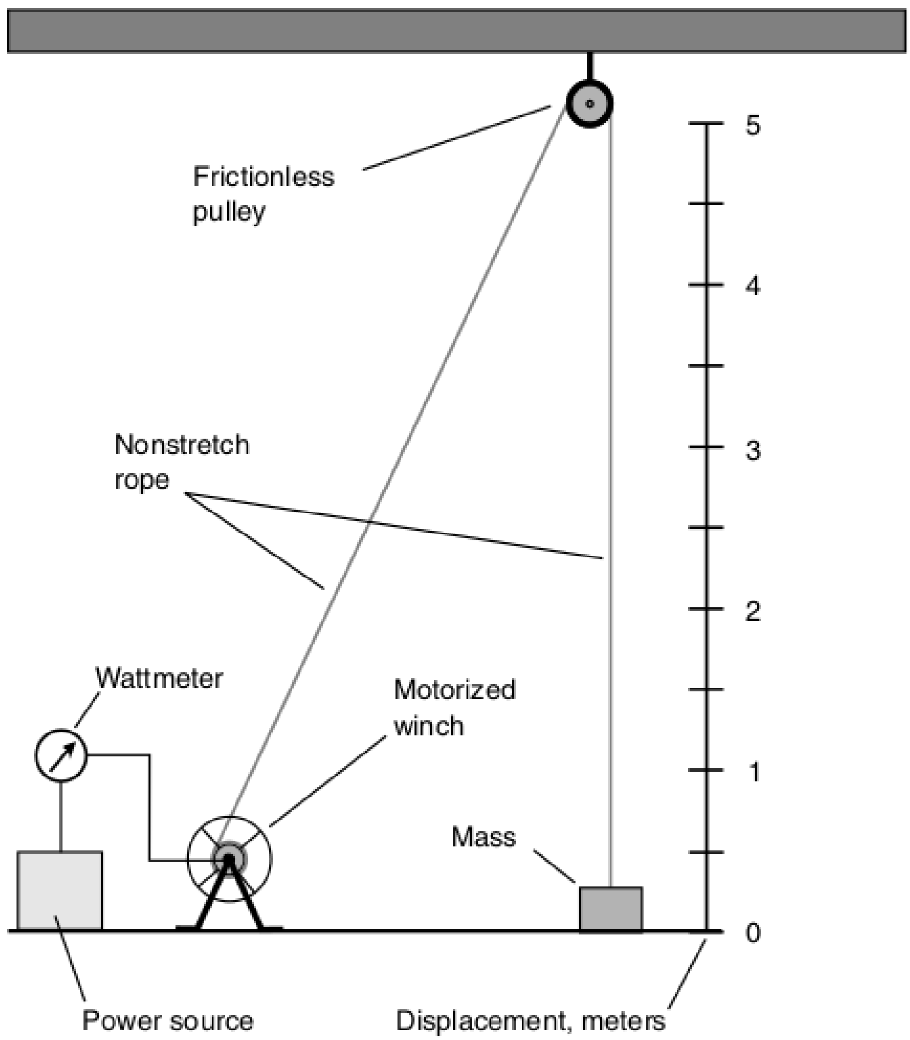


Fig. 8-6. Electrical power can be measured directly when a motor is used to drive a winch to lift a heavy object.

Fig. 8-6

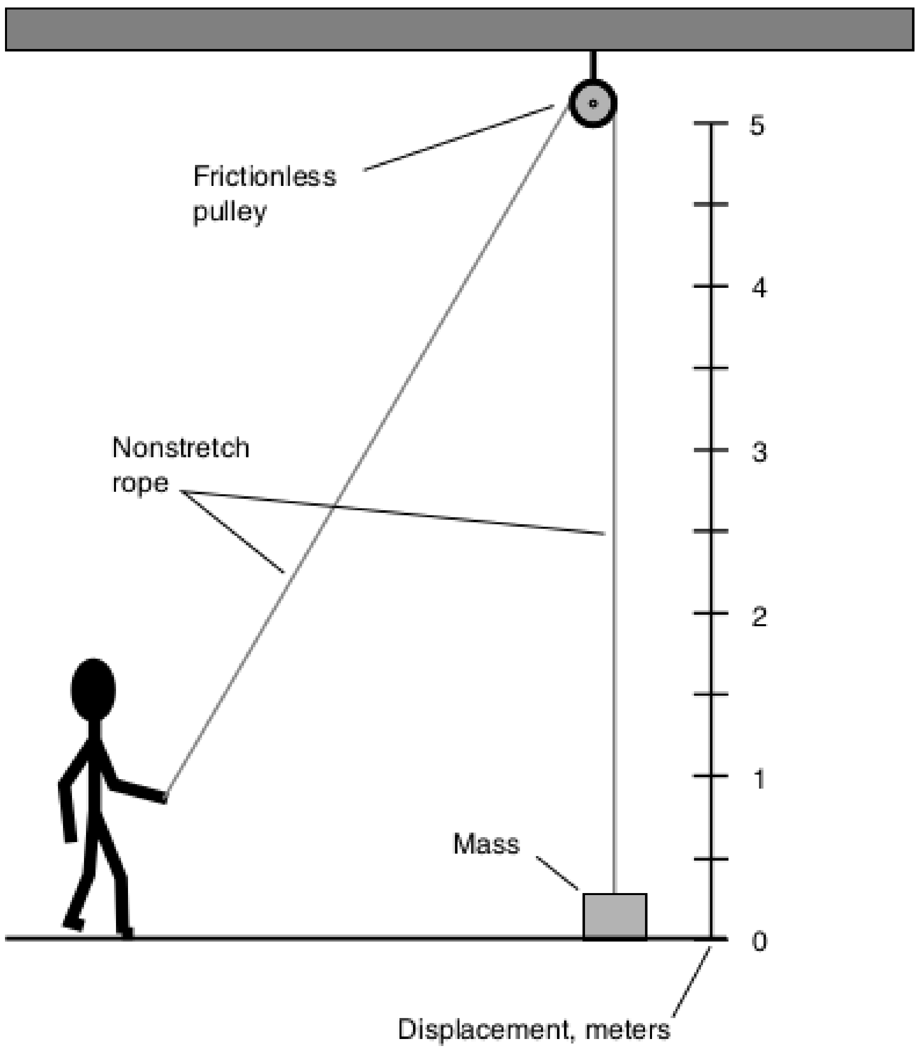


Fig. 8-4. Work is done when a force is applied over a specific distance. In this case, the force is applied upward to an object against Earth's gravity.

Fig. 8-4

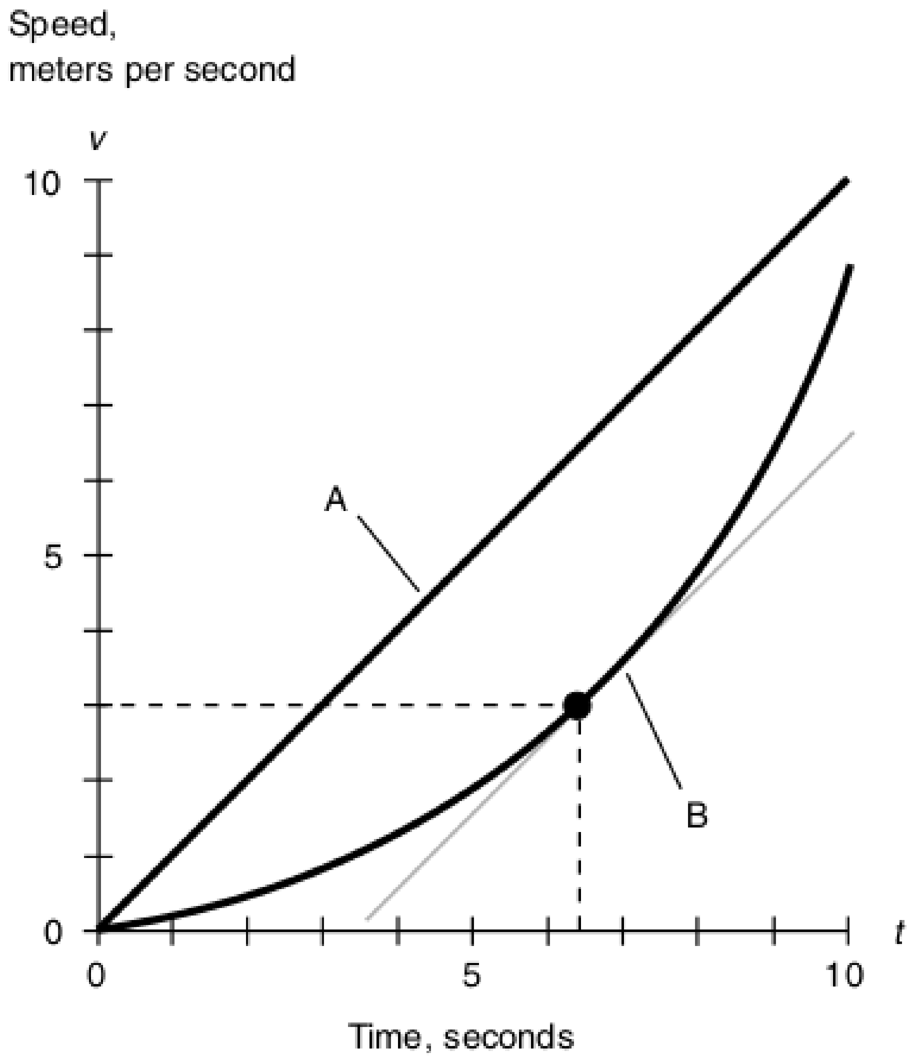


Fig. 7.9. Illustration for Problems 7-9 through 7-13.

Fig.7.9

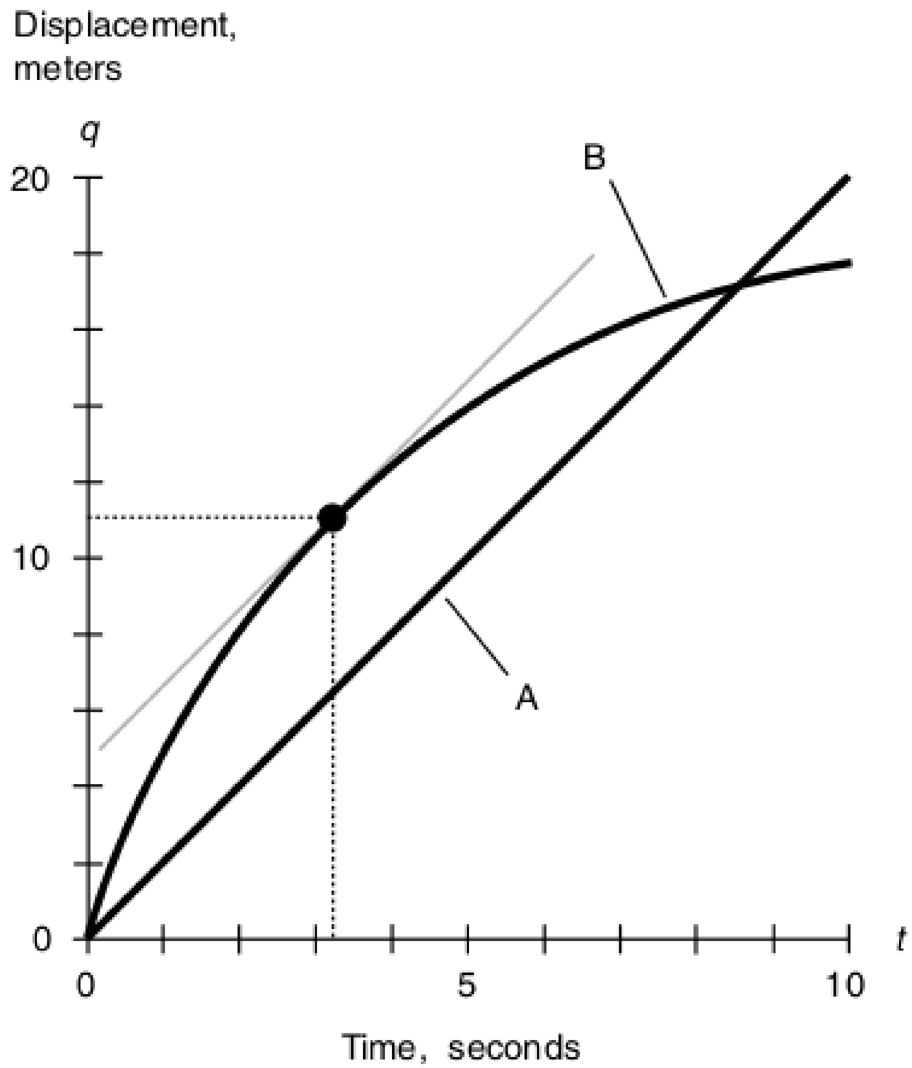


Fig. 7.5. Illustration for Problems 7-4 through 7-8.

Fig.7.5

```
  scf(gWindow)
  clf()
  plot2d(x,y,style=-9,rect=gRect) //plotting the points
  X=linspace(gRect(1),gRect(3),1000)
  plot2d(X,A*X^2+B*X+C,rect=gRect)  //plotting the parabola
//setting axis to origin
a=gca();
a.x_location="origin";
a.y_location="origin";
endfunction
```

Scilab code AP 16 `GraphSolveQL`

```
// Coded with Scilab 6.0.1 on Linux Mint 19
//Function for Graphical Solution of a quadratic and a linear equation (To plot the Graph and find solution).
/* Caution:- To be executed after QuadPointsPlot.sci is executed*/
//The function is used in Example A, page 59 and Example B, page 60 of Chapter 3.
function GraphSolveQL(f,g,gRect,gWindow)
    // f is function for the Quadratic Equation and g is function for the linear Equation
    // gRect is range for axis on Graph and gWindow is graphic window number.
  scf(gWindow);
  clf();
x=linspace(gRect(1),gRect(3),10000);

//plotting the graph of Quadratic Equation,
plot2d(x,f(x),rect=gRect)

//plotting the graph of Linear Equation
plot2d(x,g(x),rect=gRect)

```

```
//setting axis to origin
a=gca();
a.x_location="origin";
a.y_location="origin";

//Finding the solutipn(s)
//As it is clear from the equations, the graph will
   have two points of intersection i.e. the
   equations will have two solutions.
n=0; //no. of solution found

for i=-100:100
    if (f(i)==g(i) && n==0)
        x1=i;
        y1=g(i);
        n=n+1;

    elseif (f(i)==g(i) && n==1)
        x2=i;
        y2=g(i);
        n=n+1;
    end
end

//checking if both the solutions are found
if n~=2
   printf("%d solution(s) is/are found. %d Solution(
      s) is/are missing. Increase the range of
      iteration.",n,2-n)
end
printf("The coordinates of the points corresponding
   to the solutions are \n")
 printf("(%d,%d)\n",x1,y1)
 printf("(%d,%d).\n",x2,y2)

endfunction
```