Scilab Textbook Companion for Hydraulics by J. Lal[1]

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Book Description

Title: Hydraulics

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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

Chapter 1

Hydrostatics

Scilab code Exa 1.1 Pressure of water

```
clc
//initialisation of variables
h1= 2 //in
h2= 2 //in
wn= 13.6 //g/cc
w= 1 //g/cc
W= 62.4 //lbs/ft^3
//CALCULATIONS
ha= ((h2*wn/w)-h1)/12
pa= ha*W/144
//RESULTS
printf ('Pressure of water= %.2f lb/sq in ',pa)
```

Scilab code Exa 1.2 reading of mercury

```
clc
//initialisation of variables
a= 6 //ft
```

```
h= 2 //ft
sm= 13.6
sw= 1
sl=0.8
//CALCULATIONS
dh= h*(sm-sw)+a
h1= (dh-a)/(sl-1)
//RESULTS
printf ('pressure difference in ft of water= %.1f ft
    of water ',dh)
printf ('\n reading of mercury= %.f ft of liquid ',
   h1)
```

Scilab code Exa 1.3 pressure

```
clc
//initialisation of variables
sm= 13.6
so= 0.9
sw=1
ha= 12.7 //ft
hb= 8 //ft
hc= 7.5 //ft
hd= 1.75 //ft
//CALCULATIONS
pa= (sm-so)*sw
pc= -hb*so+ha
pd= ha+so*2-sm*2.5-hc
pb= hb+hd+pd
//RESULTS
printf ('pressure at A= %.2f ft of water ',pa)
printf ('\n pressure at B= %.2f ft of water ',pb)
printf ('\n pressure at C= %.2f ft of water ',pc)
printf ('\n pressure at D= %.2f ft of water ',pd)
```

Scilab code Exa 1.4 Reading of the pressure guage at the top of tank

```
clc
//initialisation of variables
lm= 2 //ft
lw= 5 //ft
lo= 8 //ft
so= 0.75
p= 40 //lb/in^2
w= 62.4 //lbs/ft^3
sm= 13.6
//CALCULATIONS
h= p*144/w
Pd= (h-lm*sm)
Pc= Pd-lw
Pb= Pc-lo*so
Pg= Pb*w/144
//RESULTS
printf ('Reading of the pressure guage at the top of
    tank = %.1f lb/in^2 ',Pg)
```

Scilab code Exa 1.5 Depth of point

```
clc
//initialisation of variables
h= 42 //in
w= 62.4 //lbs/ft^3
//RESULTS
D= h*w/(144*12)
//CALCULATIONS
printf ('Depth of point = %.1f lb/in^2 ',D)
```

Scilab code Exa 1.6 Depth of point

```
clc
//initialisation of variables
h= 200 //ft
w= 62.4 //lbs/ft^3
//RESULTS
D= h*w/(144)
//CALCULATIONS
printf ('Depth of point = %.1f lb/in^2 ',D)
```

Scilab code Exa 1.7 Total pressure

```
clc
//initialisation of variables
w= 62.4 //lbs/ft^3
l= 2 //ft
b= 3 //ft
h= 10 //ft
//CALCULATIONS
P= w*l*b*h
//RESULTS
printf ('Total pressure = %.f lb ',P)
```

Scilab code Exa 1.8 total pressure

```
clc
//initialisation of variables
l= 2 //ft
```

```
b= 3 //ft
a= 60 //degrees
h= 8 //ft
w= 62.4 //lbs/ft^3
//CALCULATIONS
x= h+(b/l)*cosd(a)
P= w*l*b*x
//RESULTS
printf ('total pressure = %.f lb ',P)
```

Scilab code Exa 1.9 total pressure

```
clc
//initialisation of variables
l= 2 //ft
b= 3 //ft
h= 8 //ft
w= 62.4 //lbs/ft^3
//CALCULATIONS
P= w*l*b*(h+(b/2))
//RESULTS
printf ('total pressure = %.f lb ',P)
```

Scilab code Exa 1.10 Total pressure

```

clc
//initialisation of variables
l= 6 //ft
b= 4 //ft
w= 62.4 //lbs/ft^3
h= 10 //ft
//CALCULATIONS
```

```
P= w*l*b*(b/2)
hn= (b/2)+(l*b^3/(12*l*b*(b/2)))
P1= w*(h+(b/2))*l*b
h1= (h+(b/2))+(l*b^3/(12*l*b*(h+(b/2))))
//RESULTS
printf("Total pressure = %d lb",P1)
printf("\n Depth = %.2f ft",hn)
printf ('\n pressure in ft in case 2= %.3f ft ',h1)
```

Scilab code Exa 1.11 position of centre of pressure

```
clc
//initialisation of variables
sp= 0.87
d= 12 //ft
W= 62.4 //lb/ft^3
Wa= 30 //lb/in^2
//CALCULATIONS
A= %pi*d^2/4
w= W*sp
x= Wa*144/(w)
P= w*A*x
h= x+(A*d^2/16/(A*x))
//RESULTS
printf ('force exerted by the oil upon the gate = %.f lb ',P)
printf ('\n position of centre of pressure = %.3f ft ',h)
```

Scilab code Exa 1.12 Level of water

```
clc
//initialisation of variables
```

```
w= 62.4 //lb/ft^3
a= 60 //degrees
l= 18 //ft
b=  4 //ft
W= 8000 //lb
//CALCULATIONS
P= w*b/(sind(a)*2)
h= ((b/(12*(sind(a))^3))*(sind(a))^2/(b/(sind(a)*2))
   )+0.5
h1= (1-h)/sind(a)
x= ((l*W)/(h1*P))^(1/3)
//RESULTS
printf ('Level of water = %.2f ft ',x)
```

Scilab code Exa 1.13 Total comression in the promp CD

```
clc
//initialisation of variables
w= 62.4 //lb/ft^3
l= 12 //ft
b= 6 //ft
h= 5.196 //ft
a= 60 //degrees
a1= 45 //degrees
//CALCULATIONS
P= w*l*b*h/2
h1= ((l*b^3*(sind(a))^2/12)/(l*b*(h/2)))+(h/2)
R= P*(b-(h1/cosd(a/2)))/((b*sind(a1))/2)
//RESULTS
printf ('Total comression in the promp CD = %.f lb '
   ,R)
```

Scilab code Exa 1.14 force F required to act horizontally at the top of gate

```

clc
//initialisation of variables
w= 62.4 //lb/ft^3
h= 4 //ft
b= 6 //ft
sg= 1.45
h1= 5 //ft
a= 90 //degrees
//CALCULATIONS
P1= w*sg*h*b*(h1+(h/2))
P2= w*h*b*(h/2)
Pr= P1-P2
hup= ((b*h^3/12)*(sind(a))^2/(h*b*(h1+(h/2))))+(h1+(h/2))
x1= h+h1-hup
hd= h*2/3
x2= h-hd
x= (P1*x1-P2*x2)/Pr
d= h1+h-x
F= Pr*x/4
//RESULTS
printf ('P resultant = %.f lb ',Pr)
printf ('\n depth of centre of pressure = %.3f ft ',d)
printf ('\n force F required to act horizontally at the top of gate = %.f lb ',F)
//The answer given in texxtbook is wrong. Please check using a calculator.
```

Scilab code Exa 1.15 RB

```
clc
//initialisation of variables
w= 15 //ft
D= 15 //ft
W= 62.4 //lb/ft^3
a= 120 //degrees
h1= 15 //ft
h2= 4 ///ft
h3= 18 //ft
//CALCULATIONS
Pu= w*D*W*w/2
hu= ((w*D^3/12)/(w^2*D/2))+w/2
Pd= W*h2*w*h2/2
hd= ((w*h2^3/12)/(h2*h1*(h2/2)))+(h2/2)
P= Pu-Pd
h= (Pu*(h1-hu)-Pd*(h2-hd))/P
F= P/(2*sind(a/4))
RT= F*(h3-(h1/10)-h)/(h3-(h1/5))
RB=F-RT
//RESULTS
printf ('RB = %.f lb ',RB)
```

Scilab code Exa 1.16 S max

```
clc
//initialisation of variables
h= 42 //ft
w= 25 //ft
d= 8 //ft
W= 150 //lb/ft^3
w1= 62.4 //lb/ft^3
//CALCULATIONS
W1= W*(h*d+(h*(w-d)/2))
P= w1*h*(h/2)
R= sqrt(W1^2+P^2)
```

```
o= atand(P/W1)
AE= (d*h*(d/2)+(w-d)*h*(d+(w-d)/3)/2)/(d*h+h*(w-d)
    /2)
EF= 14*P/W1
AF= EF+AE
AH= w/2
e= AF-AH
BS= W1*e*AH/(w^3/12)
DS= W1/w
Smax= BS+DS
Smin= DS-BS
//RESULTS
printf ('S max = %.f lb/sq ft ',Smax)
printf ('\n S min = %.f lb/sq ft ',Smin)
```

Scilab code Exa 1.17 Volume of concrete

```
clc
//initialisation of variables
W= 145 //lb/cu ft
M= 500 //lb
W1= 64 //lb/cu ft
//CALCULATIONS
dW= W-W1
V= M/dW
//RESULTS
printf ('Volume of concrete = %.1f cu ft ',V)
```

Scilab code Exa 1.18 Depth necessary to just float the ship in river

```
clc
//initialisation of variables
W= 10000 //tons
```

```
A= 15000 //ft^2
d= 15 //ft
Dsw= 64 //lb/ft^3
Dw= 62.4 //lb/ft^3
//CALCULATIONS
Vsw= 2240/Dsw
Vw= 2240/Dw
dV= Vw-Vsw
V1= W*dV
h= W/A
h1= d+h
//RESULTS
printf ('Depth necessary to just float the ship in
    river = %.2f ft ',h1)
```

Scilab code Exa 1.19 Rightening moment

```
clc
//initialisation of variables
W= 5000 //tons
w= 10 //tons
d= 30 //ft
x= 5.5 //in
l= 10 //ft
a= 15 //degrees
//CALCULATIONS
GM= (w*d)*l/(W*(x/12))
M= GM*sind(a)*W
//RESULTS
printf ('Rightening moment = %.f lb ',M)
```

Scilab code Exa 1.20 angle through which the cube will tilt

```
clc
//initialisation of variables
l= 5 //ft
h= 20 //in
n= 1/15
AG= 50 //in
x= 30 //in
w= 62.4 //lb/ft^3
//CALCULATIONS
AG1= AG/(1+n)
G1G2= n*x/(1+n)
W= l^2*w*(l/2)
h1= 32 //in
BK= h1/2
GK= 10 //in
G1K= (AG+GK)-AG1
BG1= BK-G1K
BM= (l^4/12)*2*12/(l^3*BK*n)
G1M= BM+BG1
o= atand(G1G2/G1M)
//RESULTS
printf ('angle through which the cube will tilt = %.
   f degrees ',o)
```

Chapter 2

Hydrodynamics

Scilab code Exa 2.1 v1, v2

```
clc
//initialisation of variables
Q= 0.8 //ft^3/sec
w= 62.4 //lb/sec
d1= 3 //in
d2= 1.5 //in
//CALCULATIONS
Q1= Q*w*60/10
a1= %pi*(d1/12)^2/4
a2= %pi*(d2/12)^2/4
v1= Q/a1
v2= Q/a2
//RESULTS
printf ('v1 = %.1f ft/sec ',v1)
printf ('\n v2 = %.1f ft/sec ',v2)
```

Scilab code Exa 2.2 p2

```
clc
//initialisation of variables
d1= 12 //in
d2= 9 //in
z1= 10 //ft
z2= 10 //ft
p1= 15 //lb/in^2
w= 62.4 //lb/ft^3
Q= 2 //cuses
g= 32.2 //ft/sec^2
//CALCULATIONS
v1= Q/(%pi*(d1/12)^2/4)
v2= Q/(%pi*(d2/12)^2/4)
p2= w*(z1-z2+(p1*144/w)+(v1^2/(2*g))-(v2^2/(2*g)))
    /144
//RESULTS
printf ('p2 = %.3f lb/in^2 ',p2)
```

Scilab code Exa 2.3 Discharge

```
clc
//initialisation of variables
d0= 4 //ft
d2= 2 //ft
z0 = 0 //ft
z1= 5 //ft
z2= 13 //ft
h= 9.5 //in
w= 62.4 //lb/ft^3
w1= 30 //lb/ft^3
g= 32.2 //ft/sec^2
r= 0.1
//CALCULATIONS
p2= -h*34/w1
v2= sqrt(2*g*(z1-p2-z2)/(1+r))
```

```
Q= %pi*(d2/12)^2*v2*w*60/(10*4)
//RESULTS
printf ('Discharge = %.f gpm ',Q)
```

Scilab code Exa 2.4 water pressure at top

```
clc
//initialisation of variables
d1= 2 //ft
d2= 3 //ft
v1= 20 //ft/sec
z1= 20 //ft
z2= 0 //ft
h= 5 //ft
w= 62.4 //lb/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
Hl= v1^2*0.15/(2*g)
a1= %pi*d1^2/4
a2= %pi*d2^2/4
v2= a1*v1/a2
p1= ((h-z1+(v2^2)/(2*g))-(0.85*v1^2/(2*g)))
//RESULTS
printf ('water pressure at top = %.2f ft of water ',
   p1)
```

Scilab code Exa 2.5 Discharge

```
clc
//initialisation of variables
d1= 15 //in
d2= 6//in
h= 10 //in of mercury
```

```
C= 0.98
sm= 13.6
w= 12
g= 32.2 //ft/sec^2
//CALCULATIONS
a1= %pi*(d1/12)^2/4
a2= %pi*(d2/12)^2/4
h1= h*(sm-1)/w
Q= C*(a1*a2/(sqrt(a1^2-a2^2)))*sqrt(2*g)*sqrt(h1)
   *6.24*60*60
//RESULTS
printf ('Discharge = %.f gph ',Q)
```

Scilab code Exa 2.6 Actual discharge

```
clc
//initialisation of variables
d1= 8 //in
d2= 4 //in
h= 10 //in of mercury
Cd= 0.98
g= 32.2 //ft/sec^2
sm= 13.56
//CALCULATIONS
a1= %pi*(d1/12)^2/4
a2= %pi*(d2/12)^2/4
h1= h*(sm-1)/12
Q= a1*a2*sqrt(2*g)*sqrt(h1)/sqrt(a1^2-a2^2)
Qactual= Cd*Q
//RESULTS
printf ('Actual discharge = %.2f cuses ',Qactual)
```

Scilab code Exa 2.7 speed of submarine

```
clc
//initialisation of variables
h= 6.8 //in of mercury
sm= 13.6
ssw= 1.026
g= 32.2 //ft/sec^2
//CALCULATIONS
V= sqrt(2*g*h*(sm-ssw)/12)*3600/5280
//RESULTS
printf ('speed of submarine = %.1f miles per hour ',
   V)
```

Scilab code Exa 2.8 Volume of air passing through the Venturimeter

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
d1= 2 //in
d2= 12 //in
r= 1.4
n= 0.905
Q= 2995 //lb/ft^2
w= 0.083 //lb/ft^3
//CALCULATIONS
V1= 1/w
n1= n^((r-1)/r)
n2= n^(2/r)
Q= %pi*(d1/12)^2*sqrt(2*g*Q*(1-n1)*r/((r-1)*n2*(1-(
   d1/d2)^2)))
//RESULTS
printf ('Volume of air passing through the
   Venturimeter = %.1f cuses ',Q)
```

Chapter 3

Flow Through Orifices Mouthpieces Nozzles

Scilab code Exa 3.1 Cr

```
clc
//initialisation of variables
Q= 16 //gpm
w= 62.4 //lb/ft^3
d= 1 //in
h= 2+(5/12) //ft
g= 32.2 //ft/sec^2
x= 11.5 //ft
h1= 1.2 //in
//CALCULATIONS
Cd= Q*10/(60*w*(%pi*(d/12)^2/4)*sqrt(2*g*h))
Cv= sqrt(x^2/(4*(h1/12)*h*12^2))
Cc= Cd/Cv
Cr= (1-Cv^2)/Cv^2
//RESULTS
printf ('Cr = %.3f   ',Cr)
```

Scilab code Exa 3.2 Cd, Cc

```
clc
//initialisation of variables
Ww= 261 //lb/min
a= 1 //in^2
h= 4 //ft
y=  5 //ft
W1= 10.65 //lb
l= 1 //ft
Q= 261 //lb/min
w= 62.4 //lb/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
v= Q*144/(w*60)
F= W1*l/y
v= F*g*60/Q
vth= sqrt(2*g*h)
Cv= v/vth
Q1= Ww/w
Qth= vth*60/144
Cd= Q1/Qth
Cc= Cd/Cv
//RESULTS
printf ('Cd = %.3f  ',Cd)
printf ('\n Cc = %.3f  ',Cc)
```

Scilab code Exa 3.3 Work done

```
clc
//initialisation of variables
Q= 10 //ft^3/sec
a1= 1 //ft^2
a2= 4 //ft^2
g= 32.2 //ft/sec^2
```

```
p1= 12 //lb/in^2
v1= 10 //ft/sec
w= 62.4 //lb/ft^3
//RESULTS
v2= v1*a1/a2
Hl= (v1-v2)^2/(2*g)
p2= ((p1*144/w)+(v1^2/(2*g))-(v2^2/(2*g))-Hl)*(w
    /144)
W= Hl*v1*w/550

//RESULTS
printf ('Head lost = %.3f ft of water ',Hl)
printf ('\n Pressure in larger part of pipe = %.2f
    lb/in^2 ',p2)
printf ('\n Work done = %.3f HP ',W)
```

Scilab code Exa 3.4 Pressure at Vent-contraction

```
clc
//initialisation of variables
Cc= 1
Cv= 0.833
d= 2 //in
g= 32.2 //ft/sec^2
H= 12 //ft
Pa= 34 //lb/in^2
///CALCULATIONS
Q= Cc*Cv*%pi*(d/12)^2*sqrt(2*g*H)/4
Cd= Cc*Cv
Pc= Pa-0.92*H
//RESULTS
//RESULTS
printf ('Discharge = %.3f cu ft/sec ',Q)
printf ('\n Coefficient of discharge = %.3f ',Cd)
printf ('\n Pressure at Vent-contraction= %.2f ft of
```

```
water ',Pc)
```

Scilab code Exa 3.5 Actual Discharge

```
clc
//initialisation of variables
H= 4 //ft
d= 1 //in
g= 32.2 //ft/sec^2
Cc= 0.5
//CALCULATIONS
Q= Cc*%pi*(d/12)^2*sqrt(2*g*H)/4
//RESULTS
printf ('Actual Discharge = %.4f cu ft/sec ',Q)
```

Scilab code Exa 3.6 Discharge

```
clc
//initialisation of variables
D= 4 //ft
d= 2 //in
H1= 6 //ft
H2= 2 //ft
t= 4 //min
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
H= 5 //ft
//CALCULATIONS
Cd= (2*(%pi/4)*D^2*(sqrt(H1)-sqrt(H2)))/(t*60*(%pi
    /4)*(d/12)^2*sqrt(2*g))
Q= Cd*(%pi/4)*(d/12)^2*sqrt(2*g*H)*w*60/10
//RESULTS
printf ('Cd = %.3f ',Cd)
```

```
printf ('\n Discharge = %.1f gpm',Q)
```

Scilab code Exa 3.7 time required to lower the water level

```
clc
//initialisation of variables
H1= 10 //ft
H2= 2 //ft
Cd= 0.61
d1= 8 //ft
g= 32.2 //ft/sec^2
d2= 3 //ft
//CALCULATIONS
a= d2^2/144
H0= H1*d2/(d1-d2)
t= %pi*(d1/2)^2*((2/5)*(H1^(5/2)-H2^(5/2))+2*H0^2*(
    sqrt(H1)-sqrt(H2))+(4/3)*H0*(H1^(3/2)-H2^(3/2)))
    /(60*Cd*a*sqrt(2*g)*(H1+H0)^2)
//RESULTS
printf ('time required to lower the water level = %
    .2f min',t)
```

Scilab code Exa 3.8 time required to empty the vessel

```

clc
//initialisation of variables
D= 10 //ft
H1= 17 //ft
H2= 5 //ft
d= 3 //in
Cd= 0.62
g=32.2 //ft/s^2
```

```
//CALCULATIONS
t1= (2*%pi*D^2/4)*(sqrt(H1)-sqrt(H2))/(Cd*sqrt(2*g)*
    %pi*(d/12)^2/4)
t2= %pi*(14/15)*H2^(5/2)*4/(Cd*%pi*(d/12)^2*sqrt(2*g
    ))
t= t1+t2
//RESULTS
printf ('time required to empty the vessel = %.f sec
    ',t)
```

Scilab code Exa 3.9 time to emptify biler

```
clc
//initialisation of variables
Cd= 0.8
g= 32.2 //ft/sec^2
d= 3 //in
//CALCULATIONS
t= (60*2/(%pi*(d/12)^2*sqrt(2*g)/4*Cd))*(6-d)^(3/2)
    /(3*60/2)
//RESULTS
printf ('time to emptify biler = %.2f min',t)
```

Scilab code Exa 3.11 time required to reduce the water level difference

```

clc
//initialisation of variables
H1= 9 //ft
H2= 4 //ft
Cd= 0.6
a= 4 //in^2
A1= 72 //ft^2
```

```
A2= 24 //ft^2
g=32.2 //ft/s^2
//CALCULATIONS
t= (2*A1*A2/(A1+A2))*(sqrt(H1)-sqrt(H2))*144/(Cd*60*
    a*sqrt(2*g))
//RESULTS
printf ('time required to reduce the water level
    difference = %.1f min',t)
```

Scilab code Exa 3.12 side of the square orifice

```
clc
//initialisation of variables
l= 80 //ft
w= 12 //ft
t= 3 //min
Hl= 12 //ft
g= 32.2 //ft/sec^2
Cd= 0.6
//CALCULATIONS
s= sqrt(2*l*w*Hl^(1/2)/(Cd*sqrt(2*g)*t*60))
//RESULTS
printf ('side of the square orifice = %.2f ft',s)
```

Scilab code Exa 3.13 Total discharge

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
Cd= 0.6
d= 2 //in
H1= 5 //ft
//CALCULATIONS
```

```
v= sqrt(2*g*H1)/2
q= v*Cd*%pi*(d/12)^2/4
//RESULTS
printf ('Total discharge = %.3f cfs',q)
```

Scilab code Exa 3.14 Discharge by appropriate formula

```

clc
//initialisation of variables
Cd= 0.62
H= 9 //in
l= 3 //ft
g= 32.2 //t/sec^2
//CALCULATIONS
Q1= Cd*(H*l/12)*sqrt(2*g*3*H/24)
Q2= Cd*2*l*sqrt(2*g)*((H/6)^(3/2)-(H/12)^(3/2))/3
//RESULTS
printf ('Discharge by appropriate formula = %.2f cfs
    ',Q1)
printf ('\n Discharge by exact formula = %.2f cfs',
    Q2)
```

Scilab code Exa 3.15 Total discharge

```
clc
//initialisation of variables
Cd= 0.62
B= 2.5 //ft
H2= 8 //ft
H1= 7 //ft
g= 32.2 //ft/sec^2
h= 4 //ft
```

```
//CALCULATIONS
Q1= 2*Cd*B*sqrt(2*g)*(H2^(3/2)-H1^(3/2))/3
Q2= Cd*sqrt(2*g)*sqrt(H2)*B*(h-1)
Q= Q1+Q2
//RESULTS
printf ('Total discharge = %.f cfs',Q)
```

Chapter 4

Flow Over Weirs Notches

Scilab code Exa 4.1 length of the weir

```
clc
//initialisation of variables
p= 70 //per cent
Cd= 0.6
Q= 50 //million gallons
H= 2 //ft
w= 62.4 //lb/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
Q1= p*Q*10^6*10/(100*w*24*3600)
L= Q1*3/(2*Cd*sqrt(2*g)*H^1.5)
//RESULTS
printf ('length of the weir = %.2f ft ',L)
```

Scilab code Exa 4.2 HP

```
clc
//initialisation of variables
```

```
L= 15 //ft
H= 1 //ft
Cd= 0.6
v= 80 //ft/min
g= 32.2 //ft/sec62
w= 62.4 //lb/ft^3
//CALCULATIONS
vo= v/60
Q= 2*Cd*sqrt(2*g)*L*((1+(vo^2/(2*g)))^1.5-(vo^2/(2*g
   ))^1.5)*w*100/(3*550)
//RESULTS
printf ('HP = %.f HP ',Q)
```

Scilab code Exa 4.3 discharge percent

```
clc
//initialisation of variables
L= 11 //ft
H= 0.7 //ft
Cd= 0.6
g= 32.2 //ft/sec^2
h= 1.95 //ft
Q= 20.65 //cuses
Q1= 21.2 //cfs
//CALCULATIONS
Q= 2*Cd*sqrt(2*g)*L*H^1.5/3
vo= Q/(h*L)
h1= vo^2/(2*g)
Q1= 2*Cd*sqrt(2*g)*L*((H+(vo^2/(2*g)))^1.5-(vo^2/(2*
   g))^1.5)/3
v1= Q1/(L*h)
Q2= 2*Cd*sqrt(2*g)*L*((H+(v1^2/(2*g)))^1.5-(v1^2/(2*
   g))^1.5)/3
p= (Q2-Q1)*100/Q1
//RESULTS
```

```
printf ('discharge percent = %.3f per cent ',p)
```

Scilab code Exa 4.4 K, n

```
clc
//initialisation of variables
b= 3 //ft
H= 1 //ft
Q= 9 //cfs
k= 1.105
h= 0.1 //ft
//CALCULATIONS
K= Q/b
n= (k-log10(3*K))/h
//RESULTS
printf ('K = %.f ',K)
printf ('\n n = %.1f ',n)
```

Scilab code Exa 4.5 Q

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
Cd= 0.62
L= 7.573 //ft
H= 1.2 //ft
S= 2.85 //ft
//CALCULATIONS
Q1= 2*Cd*sqrt(2*g)*L*H^1.5/3
Q2= 3.33*L*H^1.5
Q3= sqrt(2*g)*L*H^1.5*(0.405+(0.00984/H))
He= H+0.004
Q4= (3.227+0.435*(He/S))*L*He^1.5
```

```
//RESULTS
printf ('Q = %.2f cuses ',Q1)
printf ('\n Q = %.2f cuses ',Q2)
printf ('\n Q = %.2f cuses ',Q3)
printf ('\n Q = %.2f cuses ',Q4)
```

Scilab code Exa 4.6 n

```
clc
//initialisation of variables
H= 2.5 //ft
L= 10 //ft
A= 10 //miles
p= 30 //per cent
a= 2 //in/hr
w= 2 //ft
//CALCULATIONS
Q= L*1760^2*3^2*a*p/(60*60*12*100)
n= ((Q/(3.33*H^1.5))-(L-0.1*w*H))/(L-0.1*w*H)
//RESULTS
printf ('n = %.f  ',n)
```

Scilab code Exa 4.7 Total discharge

```
clc
//initialisation of variables
L= 2.5 //ft
H= 1 //ft
g= 32.2 //ft/sec^2
Cd= 0.61
L1= 1.75 //ft
L2= 2.25 //ft
//CALCULATIONS
```

```
Q1= 2*Cd*sqrt(2*g)*L*H/3
Q2= 2*Cd*sqrt(2*g)*L1*(L1^1.5-1)/3
Q3= 2*Cd*sqrt(2*g)*H*(L2^1.5-L1^1.5)/3
Q= Q1+Q2+Q3
//RESULTS
printf ('Total discharge = %.1f cfs ',Q)
```

Scilab code Exa 4.8 Percent decrease in discharge

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
h1= 16.63 //cm
h2= 10.18 //cm
h3= 16.53 //cm
//CALCULATIONS
H1= h1-h2
H2= h3-h2
p= (H1^1.5-H2^1.5)*100/H1^1.5
//RESULTS
printf ('Percent decrease in discharge = %.2f per
   cent ',p)
```

Scilab code Exa 4.9 time required to lower level of reservoir

```

clc
//initialisation of variables
Cd= 0.6
a= 20000 //yd^2
H2= 12 //in
L= 5 //ft
H1= 2 //ft
```

```
g=32.2 //ft/s^2
//CALCULATIONS
t= 2*a*9*(L-H1)*((1/sqrt(H2/12))-(1/sqrt(H1)))
   /(2*60*Cd*sqrt(2*g)*L)
//RESULTS
printf ('time required to lower level of reservoir =
    %.2f min ',t)
```

Scilab code Exa 4.10 depth of water

```
clc
//initialisation of variables
L= 3 //ft
H= 6 //in
Cd= 0.62
Cd1= 0.59
a= 45 //degrees
g= 32.2 //ft/sec^2
//CALCULATIONS
H= ((2/3)*Cd*sqrt(2*g)*L*(H/12)^1.5/((8/15)*Cd1*sqrt
   (2*g)))^0.4
//RESULTS
printf ('depth of water = %.3f ft ',H)
```

Scilab code Exa 4.11 percentage error of discharge over the weir

```
clc
//initialisation of variables
V= 20 //litres
g= 981 //cm/sec^2
Cd= 0.593
r= 2.5
r1= 1.5
```

```
e= 2 //mm
Cd1= 0.623
L= 30 //cm
//CALCULATIONS
H= (V*1000*15/(8*Cd*sqrt(2*g)))^0.4
dH1= e/10
p= r*dH1*100/H
H1= (V*3*1000/(2*Cd1*sqrt(2*g)*L))^(2/3)
p1= r1*dH1*100/H1
//RESULTS
printf ('percentage error of discharge over the weir
    = %.2f per cent ',p)
printf ('\n percentage error of discharge over the
    weir = %.2f per cent ',p1)
```

Scilab code Exa 4.12 Discharge

```
clc
//initialisation of variables
L= 16 //in
H= 9 //in
h= 18 //in
g= 32.2 //ft/sec^2
w= 2 //ft
Cd= 0.63
W= 62.4 //lbs/ft^3
//CALCULATIONS
Q= 2*Cd*sqrt(2*g)*(L/12)*(H/12)^1.5/3
v= Q/(w*(h/12))
H1= v^2/(2*g)
Q1= 2*Cd*sqrt(2*g)*(L/12)*(((H/12)+H1)^1.5-H1^1.5)*W
    *6/3
//RESULTS
printf ('Discharge = %.f gpm ',Q1)
```

Scilab code Exa 4.13 Discharge

```
clc
//initialisation of variables
L= 100 //ft
H= 2.25 //ft
Cd= 0.95
w= 120 //ft
h= 2 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
Q= 3.087*Cd*L*H^1.5
v0= Q/(w*(h+H))
Q1= 3.087*Cd*L*((H+(v0^2/(2*g)))^1.5-(v0^2/(2*g))
    ^1.5)
//RESULTS
printf ('Discharge = %.f cuses ',Q1)
```

Scilab code Exa 4.14 Discharge

```
clc
//initialisation of variables
L= 6 //ft
H1= 0.5 //ft
H2= 0.25 //ft
g= 32.2 //ft/sec^2
Cd1= 0.58
Cd2= 0.8
w= 6.24 //lb/ft^3
//CALCULATIONS
Q1= 2*Cd1*sqrt(2*g)*L*(H1-H2)^1.5/3
Q2= Cd2*L*H2*sqrt(2*g*(H1-H2))
```

```
Q= (Q1+Q2)*w*3600
//RESULTS
printf ('Discharge = %.f cuses ',Q)
```

Scilab code Exa 4.15 height of anicut which is drowned

```
clc
//initialisation of variables
W= 100 //ft
h= 10 //ft
v= 4 //ft/sec
h1= 3 //ft
g= 32.2 //ft/sec^2
H= 5.4 //ft
Cd1= 0.58
Cd2= 0.8
//CALCULATIONS
v0= (W*h*v)/(W*(h+h1))
h0 =v0^2/(2*g)
H2= (W*h*v-(2*Cd1*W*sqrt(2*g)*((h1+h0)^1.5-h0^1.5)
    /3))/(Cd2*W*sqrt(2*g*(h1+h0)))
dh= h-H2
//RESULTS
printf ('height of anicut which is drowned = %.f ft
    ',dh)
```

Scilab code Exa 4.16 length

```
clc
//initialisation of variables
x= 6 //in
l= 200 //ft
d= 10 //ft
```

```
v= 4 //ft/sec
Ce= 0.95
g= 32.2 //ft/sec^2
//CALCULATIONS
l1= sqrt(l^2/(Ce^2*(((x/12)*2*g/v^2)+(d^2/(d+(x/12))
   ^2))))
//RESULTS
printf ('length = %.f ft ',l1)
```

Scilab code Exa 4.17 Volume of extra water stored

```

clc
//initialisation of variables
g= 32.2 //ft/sec^2
H= 25 //ft
l= 2.5 //ft
b= 5 //ft
Cd= 0.64
Q= 3200 //cuses
L=150 //ft
C=3.2
depth=0.5 //ft
A1=5000000 //sq yards
//CALCULATIONS
Q1= Cd*l*b*sqrt(2*g*H)
n= Q/Q1
h= (Q/(3.2*L))^(2/3)
hr=h-depth
Area=A1*9
V=Area*hr
//RESULTS
printf ('number of spilways = %.f ',n)
printf("\n Volume of extra water stored = %d cu ft",
   V)
```

Chapter 5

Flow Through Pipes

Scilab code Exa 5.1 hydraulic mean depth

```
clc
//initialisation of variables
h= 4 //ft
h1= 3 //ft
r= 3 //ft
h2= 1.5 //ft
//CALCULATIONS
m= (h*h1+(h1^2/2))/(h+(h/2)*sqrt(h1^2+(h1/2)^2))
a= 2*acosd(h2/r)
P= 2*%pi*r*a/360
A= r^2*((2*%pi/3)-sind(a))/2
H= A/(2*%pi)
//RESULTS
printf ('hydraulic mean depth = %.3f ft ',H)
```

Scilab code Exa 5.2 example 2

```
clc
```

```
//initialisation of variables
d= 3 //ft
l= 5280 //ft
v= 3 //ft/sec
f= 0.005
g= 32.2 //ft/sec^2
C= 115
//CALCULATIONS
hf= 4*f*l*v^2/(2*g*v)
m= d/4
hf1= (v/C)^2*4*l/3
//RESULTS
printf ('hf = %.2f ft ',hf)
printf ('\n hf = %.2f ft ',hf1)
```

Scilab code Exa 5.3 example 3

```
clc
//initialisation of variables
d= 6 //in
Q= 2 //cfs
l= 1000 //ft
f= 0.0055
w= 62.4 //lb/ft^3
g= 32.2 //ft/sec^2
h= 70 //ft
//CALCULATIONS
v= Q/(%pi*(d/12)^2/4)
hf= 4*f*l*w*(Q/(%pi*(d/12)^2/4))^2/((d/12)*2*144*g)
P= hf+(h*w/144)
//RESULTS
printf ('pressure = %.1f lb/in^2 ',hf)
printf ('\n presure difference = %.2f lb/in^2 ',P)
```

Scilab code Exa 5.4 example 4

```
clc
//initialisation of variables
d= 6 //in
hf= 7.7 //ft
f= 0.005
l= 1000 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
C= sqrt(2*g/f)
Q= %pi*C*(d/12)^2.5*(hf/1000)^0.5 /8
//RESULTS
printf ('Discharge = %.2f cfs ',Q)
```

Scilab code Exa 5.5 example 5

```
clc
//initialisation of variables
Q= 400000
d= 4 //miles
h= 50 //ft
q= 40 //gallons of water
t= 8 //hr
f= 0.0075
w= 6.24 //lb/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
Q1=Q*q*0.5/(t*60*60*w)
d= (4*f*(d*5280)*Q1^2*16/(%pi^2*h*2*g))^0.2*12
//RESULTS
```

```
printf ('size of the supply = %.1f in ',d)
```

Scilab code Exa 5.6 example 6

```
clc
//initialisation of variables
Q= 0.7 //cfs
d= 6 //in
v1= 1.084*10^-5 //ft^2/sec
v2= 0.394*10^-5 //ft^2/sec
R= 2320
//CALCULATIONS
v3= R*v1/(d/12)
v4=R*v2/(d/12)
v= Q*4/(%pi*(d/12)^2)
//RESULTS
printf ('crititcal velocity = %.4f ft/sec ',v4)
printf ('\n actual velocity = %.2f ft/sec ',v)
```

Scilab code Exa 5.7 example 7

```

clc
//initialisation of variables
p= 0.91 //units
u= 0.21 //poise
q= 200 //gallons
h= 40 //ft
l= 200 //ft
w= 62.4 //lb/ft^3
d= 3/4 //in
g=32.2 //ft/s^2
//CALCULATIONS
```

```
v= u/(p*(30.5)^2)
Q= q*10/(w*3600*p)
V= Q/(%pi*(d/12)^2/4)
Re= V*(d/12)/v
F= 64/Re
Hf= F*l*V^2/(2*g*(d/12))
Ht= Hf+h
P= w*p*Ht/144
//RESULTS
printf ('Pressure head  = %.1f lb/in^2 ',P)
```

Scilab code Exa 5.8 example 8

```
clc
//initialisation of variables
logh= 0.1761
logk= -0.415
logv= 0.3010
//CALCULATIONS
n= (logh-logk)/logv
//RESULTS
printf ('n = %.2f  ',n)
```

Scilab code Exa 5.10 Pressure differnece at discharge end

```
clc
//initialisation of variables
pb= 20 //lb/in^2
w= 62.4 //lb/ft^3
Q= 1.96 //cfs
d1= 0.5 //ft
d2= 1 //ft
f= 0.005
```

```
g= 32.2 //ft/sec^2
l1= 300 //ft
H= 14.015 //ft of water
//CALCULATIONS
v1= Q/(%pi*d1^2/4)
v2= Q/(%pi*d2^2/4)
hf1= 4*f*l1*v1^2/(2*g*d1)
hf2= 4*f*l1*v2^2/(2*g*d2)
h= (v1-v2)^2/(2*g)
h1= v1^2/(2*g)
h2= v2^2/(2*g)
P= H*w/144
//RESULTS
printf ('Loss of head at C = %.3f ft ',h)
printf ('\n Loss of head at C = %.2f ft ',h1)
printf ('\n Loss of head at C = %.3f ft ',h2)
printf ('\n Pressure differnece at discharge end = %
    .2f lb/in^2 ',P)
```

Scilab code Exa 5.11 example 11

```
clc
//initialisation of variables
d= 8 //in
l= 6000 //ft
H= 100 //ft
H1= 1000 //ft
f= 0.008
g= 32.2 //ft/sec^2
h1= 24 //ft
h2= 34 //ft
h3= 25 //ft
w= 6.24 //lb/ft^3
//CALCULATIONS
v= sqrt(H*d*2*g/(4*f*l*12))
```

```
h= -h1+(v^2/(2*g))+h3+(4*f*H1*v^2/(2*g*(d/12)))
Q= %pi*(d/12)^2*v*3600*w/4
//RESULTS
printf ('minimum depth = %.f ft ',h)
printf ('\n Discharge = %.f gpm',Q)
```

Scilab code Exa 5.12 example 12

```
clc
//initialisation of variables
h= 25 //ft
l= 2000 //ft
d= 12 //in
g= 32.2 //ft/sec^2
f= 0.005
dz= 16 //ft
zb= 25 //ft
zc= -16 //ft
//CALCULATIONS
v= sqrt(2*g*h/(1.5+(4*f*l/(d/12))))
Q= %pi*(d/12)^2*v/4
l1= (34-dz)*l/(zb-zc-dz)
//RESULTS
printf ('Discharge = %.1f cfs ',Q)
printf ('\n length of the inlet = %.f ft of water ',
  l1)
```

Scilab code Exa 5.13 example 13

```
clc
//initialisation of variables
d1= 2 //in
l1= 25 //ft
```

```
d2= 4 //in
l2= 140 //ft
v= 4 //ft/sec
g= 32.2 //ft/sec^2
f= 0.0065
//CALCULATIONS
v1= v*(d2/d1)^2
H= (0.5*v1^2/(2*g))+(4*f*l1*12*v1^2/(d1*2*g))+((v1-v
    )^2/(2*g))+(4*f*l2*12*v^2/(d2*2*g))+(v^2/(2*g))
//RESULTS
printf ('necessaey height of water = %.3f ft ',H)
```

Scilab code Exa 5.14 example 14

```
clc
//initialisation of variables
l1= 3000 //ft
d1= 18 //in
l2= 1500 //ft
d2= 15 //ft
l3= 1000 //ft
d3= 12 //in
//CALCULATIONS
d= ((l1+l2+l3)/((l1/d1^5)+(l2/d2^5)+(l3/d3^5)))
    ^(1/5)
//RESULTS
printf ('Diameter = %.2f in ',d)
```

Scilab code Exa 5.15 example 15

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
```

```
D= 9 //in
//CALCULATIONS
d= D/(2^0.4)
//RESULTS
printf ('diameter of paralle mains = %.2f in ',d)
```

Scilab code Exa 5.16 example 16

```
clc
//initialisation of variables
d= 2 //ft
l= 5280 //ft
f= 0.01
H= 100 //ft
g= 32.2 //ft/sec^2
//CALCLATIONS
v= sqrt(H*2*d*g/(4*f*l))
Q= %pi*d^2*v/4
r= d
v2= sqrt(H/((r^2+1)*(4*f*l/(2*2*2*g))))
Q1= 2*%pi*d^2*v2/4
dQ= Q1-Q
p= dQ*100/Q
//RESULTS
printf ('percentage increase in discharge = %.1f per
    cent ',p)
```

Scilab code Exa 5.18 example 18

```
clc
//initialisation of variables
A= 10000 //ft^2
H1= 50 //ft
```

```
H2= 40 //ft
l= 1500 //ft
d= 6 //in
f= 0.0075
g= 32.2 //f/sec^2
//CALCULATIONS
t= 2*A*sqrt((1.5+(4*f*l/(d/12)))/(2*g))*(sqrt(H1)-
   sqrt(H2))/(%pi*(d/12)^2/4)
//RESULTS
printf ('Time taken to lower the level of water = %.
   f sec ',t)
```

Scilab code Exa 5.19 example 19

```
clc
//initialisation of variables
l= 24 //ft
b= 12 //ft
f= 0.006
d= 4 //in
l1= 25 //ft
H1= 6 //ft
H= 20 //ft
g= 32.2 //ft/sec^2
Cd= 0.6
//CALCULATIONS
a= %pi*(d/12)^2/4
A= l*b
H2= H1+H
t= 2*A*sqrt((1.5+(4*f*l1/(d/12)))/(2*g))*(sqrt(H2)-
   sqrt(H))/a
t1= 2*A*sqrt((1.5+(4*f*l1/(d/12)))/(2*g))*sqrt(H1)/a
t2= 2*A*sqrt(H1)/(Cd*a*sqrt(2*g))
//RESULTS
printf ('Time taken to lower the pipe = %.f sec ',t)
```

```
printf ('\n Time taken to lower the pipe = %.f sec ',t1)
printf ('\n Time taken to lower the pipe = %.f sec ',t2)
```

Scilab code Exa 5.20 example 20

```
clc
//initialisation of variables
d= 2 //ft
l= 1000 //ft
f= 0.0075
H1= 20 //ft
A1= 100000 //ft^2
A2= 50000 //ft^2
g= 32.2 //ft/sec^2
//CALCULATIONS
h= 2*A1/A2
H2= H1-h
t= 2*A1*A2*sqrt(1.5+(4*f*l/2))*0.47/((A1+A2)*(%pi*d^2/4)*sqrt(2*g))/60
//RESULTS
printf ('Time taken to lower the level of water = %.f min ',t)
```

Scilab code Exa 5.21 example 21

```
clc
//initialisation of variables
H= 1000 //lb/in^2
Hf= 100 //lb/in^2
l= 10 //miles
HP= 100
```

```
g= 32.2 //ft/sec^2
w= 64.4 //lb/ft^3
f= 0.006
//CALCULATIONS
n= (H-Hf)*100/H
v= Hf*550/((%pi/4)*n*10*144)
r= Hf*144*2*g/(w*4*f*l*5280)
d= (v^2/r)^(1/5)
//RESULTS
printf ('Diameter = %.4f ft ',d)
```

Scilab code Exa 5.22 example 22

```
clc
//initialisation of variables
h1= 1640 //ft
h2= 40 //ft
d= 8 //in
l= 2 //miles
D= 3 //ft
f= 0.006
Cv= 0.98
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
//CALCULATIONS
r= (d/12)/D
vact= Cv*sqrt(2*g*(h1-h2)/(1+(4*f*l*5280*r^4/D)))
HP= w*vact^3*(%pi*(d/12)^2/4)/(550*2*g)
//RESULTS
printf ('Horse Power of Jet = %.f HP ',HP)
```

Scilab code Exa 5.23 example 23

```
clc
//initialisation of variables
p= 60 //lb/in^2
l= 300 //ft
D= 2.5 //in
d= 7/8 //in
f= 0.018
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
//CALCULATIONS
r= (D/d)^4
V= sqrt(2*g*144*p/(w*(r+0.5+(4*f*l/(D/12)))))
Q= V*(%pi*(D/12)^2)/4
//RESULTS
printf ('Volume of flow = %.3f cu ft/sec ',Q)
```

Scilab code Exa 5.24 example 24

```
clc
//initialisation of variables
D= 3 //in
l= 800 //ft
H= 120 //ft
f= 0.01
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
//CALCULATIONS
d= ((D/12)^5/(8*f*l))^0.25
hf= H/3
dh= H-hf
v= sqrt(hf*(D/12)*2*g/(4*f*l))
HPmax= w*%pi*((D/48)^2/4)*v*dh/550
//RESULTS
printf ('HPmax = %.3f HP ',HPmax)
```

Scilab code Exa 5.25 example 25

```
clc
//initialisation of variables
l= 2 //miles
Q= 2*10^6 //gal/day
d= 12 //in
t= 16 //sec
w= 62.4 //lb/ft^3
g= 32.2 //ft/sec^2
//CALCULATIO
Q1=Q*10/(w*24*60*60)
hi= l*5280*Q1/((%pi*(d/12)^2/4)*(g*t))
//RESULTS
printf ('height = %.1f ft ',hi)
```

Scilab code Exa 5.26 example 26

```
clc
//initialisation of variables
d= 6 //in
Q= 0.7854 //cfs
E= 30*10^6 //lb/in^2
t= 0.25 //in
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
K= 300000 //lb/in^2
//CALCULATIONS
v= Q/(%pi*(d/12)^2/4)
p= v/(sqrt(144*(g/w)*((1/K)+(d/(t*E)))))
//RESULTS
```

```
printf ('rise of presure in the pipe = %.f lb/in^2 '
    ,p)
```

Scilab code Exa 5.27 example 27

```
clc
//initialisation of variables
w= 62.4 //lb/ft^3
f= 0.005
Q= 100 //cuses
m= 40 //Rs
n= 0.75
n1= 0.065
K= 15 //Rs
//CALCULATIONS
d= ((5*w/(1.5*550*10))*n*f*Q^3*m/(K*n1))^(1/6.5)
//RESULTS
printf ('economical diameter of pipe line = %.3f ft
    ',d)
```

Chapter 6

Flow Through Open Channels

Scilab code Exa 6.1 example 1

```
clc
//initialisation of variables
i= 0.000146
v= 2.8 //ft/sec
m= 7 //ft
//CALCULAIONS
C= v/sqrt(m*i)
K= (157.6-C)*sqrt(m)/C
//RESULTS
printf ('K = %.3f  ',K)
```

Scilab code Exa 6.2 example 2

```
clc
//initialisation of variables
b= 10 //ft
n= 1
i= 1/1000
```

```
d= 1.5 //ft
C= 110
w= 62.4 //lb/ft^3
//CALCULATIONS
L= sqrt(2*d^2)
P= b+2*L
A= d*(b+n*d)
m= A/P
v= C*sqrt(m*i)
Q= A*v*w*60*60*24/10
//RESULTS
printf ('Discharge = %.2e gal/day ',Q)
```

Scilab code Exa 6.3 example 3

```
clc
//initialisation of variables
b= 10 //ft
n= 2
d= 3.5 //ft
i= 1/625
//CALCULATIONS
A= d*(b+(d/n))
L= sqrt(d^2+(d/2)^2)
P= b+2*L
m= A/P
v= 1.486*m^(2/3)*i^0.5/0.03
Q= A*v
//RESULTS
printf ('Discharge = %.1f cuses ',Q)
```

Scilab code Exa 6.4 example 4

```
clc
//initialisation of variables
d= 3 //ft
i= 1/4500
C= 80
//CALCULATIONS
A= 0.5*(%pi*d^2/4)
P= %pi*d/2
m= A/P
v= C*sqrt(m*i)
Q= v*A
//RESULTS
printf ('Discharge = %.2f cuses ',Q)
```

Scilab code Exa 6.5 example 5

```
clc
//initialisation of variables
A= 2500 //acres
n= 20
Q= 40 //gal/head
C= 130
i= 1/3000
p = 7 //per cent
w= 62.4 //lb/ft^3
//CALCULATIONS
Q1= Q*50000*p/(60*100*60*w)
Q2= Q1+(A*4840*9/(12*24*60*60))
d= (Q2*8*sqrt(4/i)/(%pi*C))^0.4
//RESULTS
printf ('Diameter = %.3f ft ',d)
```

Scilab code Exa 6.6 example 6

```
clc
//initialisation of variables
Qt= 150000 //cuses
i= 1/10000
n1= 1
n2= 2/3
d1= 30 //ft
C1= 100
C2= 75
b1= 600 //ft
b2= 2000 //ft
r= 2
A1= (b1+d1)*d1
P1= b1+(2*d1*sqrt(2))
m1= A1/P1
v1= C1*sqrt(m1*i)
Q1= A1*v1
Q2= Qt-Q1
v2= v1/2
A2= Q2/v2
d2= (-b2+sqrt(b2^2+4*1.5*A2))/(2*1.5)
//RESULTS
printf ('depth of water = %.f ft ',d2)
```

Scilab code Exa 6.7 example 7

```
clc
//initialisation of variables
d= 3 //ft
i= 1/1000
C= 65
Cd= 0.56
g= 32.2 //ft/sec^2
h1= 7.5 //ft
h2= 3 //ft
```

```
//CALCULATIONS
m= d
v= C*sqrt(m*i)
Q= v*d
H= (Q*d/(2*sqrt(2*g)*Cd))^(2/3)
h= h1+h2-H
//RESULTS
printf ('Height of dam = %.2f ft ',h)
```

Scilab code Exa 6.8 example 8

```
clc
//initialisation of variables
Q=100//cuses
v= 2 ///ft/sec
n= 1.5
A= 50 //ft^2
C= 120
//CALCULATIONS
d= sqrt((Q/v)/(2*sqrt(n^2+1)-n))
m= A/d
h1= m-n*d
h2= m+n*d
i= (v/C)^2*(2/d)
//RSULTS
printf ('Depth = %.2f ft ',d)
printf ('\n Bottom width = %.2f ft ',h1)
printf ('\n Top width = %.2f ft ',h2)
```

Scilab code Exa 6.9 example 9

```
clc
//initialisation of variables
```

```
Q= 1100 //cuses
i= 1/1800
C= 95
n= 1.5
//CALCULATIONS
d= ((Q*sqrt(3600)/C)/(n+0.6))^0.4
b= 0.6*d
ht= b+2*(n*d)
//RESULTS
printf ('Depth = %.2f ft ',d)
printf ('\n Bottom width = %.2f ft ',b)
printf ('\n Top width = %.2f ft ',ht)
```

Scilab code Exa 6.10 example 10

```
clc
//initialisation of variables
n= 1.5
Q= 800 //cuses
i= 2.5/5280
n1= 9.24
r= 0.6
k= 1.49
//CALCULATIONS
d= (k*10^7*4/n1)^(1/8)
//RESULTS
printf ('Depth of channel = %.1f ft ',d)
```

Scilab code Exa 6.11 example 11

```
clc
//initialisation of variables
d= 8 //ft
```

```
i= 1/1200
C= 90
a= 308 //degrees
//CALCULATIONS
h= 0.95*d
A= (d/2)^2*(a*(%pi/180)-sind(a))/2
m= 0.29*d
Q= A*C*sqrt(m*i)
//RESULTS
printf ('Discharge = %.f cuses ',Q)
```

Scilab code Exa 6.12 example 12

```
clc
//initialisation of variables
v= 5 //ft/sec
Q= 500 //cuses
w= 25 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
h= (Q/v)/w
E= h+(v^2/(2*g))
//RESULTS
printf ('Specific energy = %.2f ft ',E)
```

Scilab code Exa 6.13 example 13

```
clc
//initialisation of variables
i= 1/5000
C= 100
b= 50 //ft
h= 10 //ft
```

```
Q= 1000 //cuses
g= 32.2 //ft/sec^2
//CALCULATIONS
f= 2*g/C^2
m= (b*h)/(b+2*h)
v= Q/(b*h)
r= (i-(f*4/(2*g*m)))/(1-(2^2/(g*h)))
s= i-r
//RESULTS
printf ('Slope = %.6f  ',s)
```

Scilab code Exa 6.14 example 14

```
clc
//Initialization of variables
B=48 //ft
D=5 //ft
f=0.005
i=1/1000
g=32.2
//calculations
C=sqrt(2*g/f)
m=B*D/(B+2*D)
V=C*sqrt(m*i)
Q=B*D*V
Dc=(Q^2 /(g*B^2))^(1/3)
d1=2.25 //ft
Q1=1*D*V
d2=-d1/2 + sqrt(2*Q1^2 /(g*d1) + d1^2 /4)
hd=d2-d1
//results
printf("height required = %.3f ft",hd)
//The answer is a bit different due to rounding off
   error in textbook
```

Scilab code Exa 6.15 example 15

```

clc
//initialisation of variables
Q= 360 //cfs
d1= 1 //ft
B= 18 //ft
g= 32.2 //ft/sec^2
w1= 624. //lb/ft^3
d2=4.5  //ft
//CALCULATIONS
w= Q/B
v1= w/d1
v2= v1/d2
d2= -0.5+sqrt((2*v1^2*d1/(g))+(d1^2/4))
El= (d1+(w^2/(2*g)))-(d2+(v2^2/(2*g)))
EL= w1*Q*El
//RESULTS
printf ('loss in energy = %.f lb ',EL)
```

Scilab code Exa 6.16 example 16

```
clc
//initialisation of variables
d1= 4 //ft
v1= 60 //ft/sec
g= 32.2 //ft/sec^2
//CALULATIONS
d2= d1*(sqrt(1+8*v1^2/(g*d1))-1)/2
//RESULTS
printf ('d2 = %.f ft ',d2)
```

Scilab code Exa 6.17 example 17

```
clc
//initialisation of variables
b= 150 //ft
d= 12 //ft
N= 0.03
i= 1/10000
h= 10 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
A= b*d
P= b+2*d
m= A/P
v= m^(2/3)*1.49*i^0.5/N
A1= b*(h+d)
P1= b+2*(h+d)
m1= A1/P1
C1= 1.49*m1^(1/6)/N
v1= A*v/A1
s= (i-(v1^2/(C1^2*m1)))/(1-(v1^2/(g*(h+d))))
L= 2*h/s
//RESULTS
printf ('Length of back water = %.f ft ',L)
```

Scilab code Exa 6.18 example 18

```
clc
//initialisation of variables
b1= 3.2 //ft
b2= 1.3 //ft
```

```
h1= 1.86 //ft
h2= 1.63 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
a1= b1*h1
a2= b2*h2
Q= a1*a2*sqrt(2*g)*sqrt(h1-h2)/(sqrt(a1^2-a2^2))
//RESULTS
printf ('Discharge = %.1f cuses ',Q)
```

Scilab code Exa 6.19 example 19

```
clc
//initialisation of variables
b1= 4 //ft
b2= 2 //ft
h1= 2 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
Qmax= 3.09*b2*h1^1.5
v1= Qmax/(b1*h1)
H= h1+(v1^2/(2*g))
Qmax2= 3.09*b2*H^1.5
h2= 2*H/3
//RESULTS
printf ('Qmax = %.2f cfs ',Qmax)
printf ('\n Qmax = %.2f cfs ',Qmax2)
printf ('\n h2 = %.3f ft ',h2)
```

Scilab code Exa 6.20 example 20

```
clc
//initialisation of variables
```

```
h1= 8 //ft
b1= 32 //ft
h= 1 //ft
b2= 24 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
H= h1-h
Q= 3.09*H^1.5*b2
v1= Q/(b1*h1)
Q1= 3.09*(H+(v1^2/(2*g)))^1.5*b2
hc= (Q1^2/(g*b2^2))^(1/3)
d2= -(hc/2)+sqrt(9*hc^2/2)+h
//RESULTS
printf ('Q = %.f cfs ',Q1)
printf ('\n hc = %.2f ft ',hc)
printf ('\n max depth = %.2f ft ',d2)
```