Scilab Textbook Companion for Hydraulics Made Easy by R. S. Dighe[1]

Created by
Kvp Pradeep
Chemical engineering
Chemical Engineering
IIT Bombay
College Teacher
Na
Cross-Checked by
Lavitha Pereira

November 30, 2013

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Textbook Companion and Scilab codes written in it can be downloaded from the "Textbook Companion Project" section at the website http://scilab.in

Book Description

Title: Hydraulics Made Easy

Author: R. S. Dighe

Publisher: Royal Book Stall

Edition: 1

Year: 2005

ISBN: 0415250706

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 example 1

```
clc
//initialisation of variables
Ar= 50 //in^2
Ap= 1/8 //in^2
Wp= 5 //lbs
//CALCULATIONS
Pp= Wp/Ap
F= Pp*Ar
//RESULTS
printf ('weight supported by ram = %.f lbs',F)
```

Scilab code Exa 1.2 example 2

```
clc
//initialisation of variables
Dp= 1 //in
Dr= 10 //in
R= 12
```

```
W= 15 //tons
//CALCULATIONS
Ar= %pi*Dr^2/4
Ap= %pi*Dp^2/4
P= W*2240/((Ar/Ap)*R)
//RESULTS
printf ('power applied to lever = %.f lbs',P)
```

Scilab code Exa 1.3 example 3

```
clc
//initialisation of variables
Dj= 1 //in
Dr= 2 //in
W= 40 //lbs
W1= 1 //ton
rl= 20
//CALCULATIONS
Ap= %pi*Dj^2/4
Ar= %pi*Dr^2/4
Vrj= rl*Ar/Ap
e= W1*2240*100/(W*Vrj)
//RESULTS
printf ('efficiency of machine at this load = %.f
    percent',e)
```

Scilab code Exa 1.4 example 4

```
clc
//initialisation of variables
Dj= 1 //in
Dr= 2 //in
ns= 3 //strokes
```

```
h= 2 //ft
//CALCULATIONS
Ap= %pi*Dj^2/4
Ar= %pi*Dr^2/4
Vrj= Ar/Ap
ns1= h*12*Vrj/ns
//RESULTS
printf ('working strokes = %.f strokes',ns1)
```

Scilab code Exa 1.5 example 5

```
clc
//initialisation of variables
T= 40 //F
w= 62.4 //lbs/ft^3
h= 50 //ft
//CALCULATIONS
p= w*h/(12^2)
//RESULTS
printf ('pressure at a depth of 50 ft = %.2f lbs
   per in',p)
```

Scilab code Exa 1.6 example 6

```
clc
//initialisation of variables
W= 64 //lbs/ft^3
h1= 27 //ft
h2= 9 //ft
w= 40 //ft
//CALCULATIONS
Pr= w*W*h1*h1/2
Pl= w*W*h2*h2/2
```

```
y1= h1/3
y2= h2/3
y= (Pr*y1-Pl*y2)/(Pr-Pl)
//RESULTS
printf (' point of application = %.2f ft',y)
```

Scilab code Exa 1.7 example 7

```
clc
//initialisation of variables
d= 5 //ft
x= 3 //ft
w= 62.4 //lb/ft^3
a= 90 //degrees
//CALCULATIONS
h= ((%pi*d^4/64)+(x^2*%pi*d^2/4))/(%pi*d^2*x/4)
//RESULTS
printf ('depth of the pressure= %.2f ft',h)
```

Scilab code Exa 1.8 example 8

```
clc
//initialisation of variables
w= 3 //ft
h= 4 //ft
ht= 30 //ft
W= 62.4 //ft^3
//CALCULATIONS
Ap= w*h
X= ht+(h/2)
P= Ap*X*W
I0= (w*h^3/12)+Ap*X^2
H= I0/(Ap*X)
```

```
//RESULTS
printf (' total pressure on the gate = %.2f ft',H)
```

Scilab code Exa 1.9 example 9

```
clc
//initialisation of variables
w= 3 //ft
h= 4 //ft
ht= 30 //ft
W= 62.4 //ft^3
x= 2.22 //in
x1= 4.5 //in
//CALCULATIONS
Ap= w*h
X= ht+(h/2)
P= Ap*X*W
T= P*x/x1
T1= P-T
//RESULTS
printf (' tension devoloped in the top bolt = %.f
   lbs',T)
printf (' \n tension devoloped in the bottom bolt =
   %.f lbs',T1)
```

Scilab code Exa 1.10 example 10

```
clc
//initialisation of variables
w= 3 //ft
h= 15 //ft
d= 140 //lbs/ft^3
x= 6 //in
```

```
W= 62.4 //lbs/ft^3
//CALCULATIONS
W1= h*w*d
h= (W1*x*6/(W*12))^(1/3)
//RESULTS
printf (' height of water rise = %.2f ft',h)
```

Scilab code Exa 1.11 example 11

```
clc
//initialisation of variables
h= 5 //ft
d= 6 //ft
a= 30 //degrees
w= 62.4 //lbs/ft^3
//CALCULATIONS
A= %pi*d^2/4
X= h+(d/2)*sind(a)
P= w*A*X
Ic= %pi*d^4/64
I0= Ic+A*X^2/(sind(a))^2
h= I0*(sind(a))^2/(A*X)
//CALCULATIONS
printf ('depth of the centre os pressure= %.2f ft ',
   h)
```

Scilab code Exa 1.12 example 12

```
clc
//initialisation of variables
w= 4 //ft
l= 4 //ft
X= 10 //ft
```

```
a= 45 //degrees
W= 100 //lbs
a1= 60 //degrees
w1= 62.4 //lbs/ft^3
//CALCULATIONS
A= w*l
X1= X+(w/2)*sind(a)
Ig= w*l^3/12
I0= Ig+(A*X1^2/(sind(a))^2)
h= I0*(sind(a))^2/(A*X1)
P= w1*A*X1
h1= h-X
h2= h1/sind(a)
T= (W*(l/2)*sind(a)+P*h2)/(w*sind(a1))
//RESULTS
printf ('Pull in the chain= %.f lbs ',T)
```

Scilab code Exa 1.13 example 13

```

clc
//initialisation of variables
w= 4 //ft
l= 4 //ft
X= 10 //ft
a = 45 //degrees
W= 62.4 //lbs/ft^3
u= 0.25
//CALCULATIONS
A= w*l
X1= X+(w/2)*sind(a)
P= W*A*X1
T= u*P
//RESULTS
printf ('magnitude of the lifting force= %.f lbs ',T
```

)

Scilab code Exa 1.14 example 14

```
clc
//initialisation of variables
w= 62.4 //lbs/ft^3
sg= 1.6
h= 10 //ft
h1= 4 //ft
//CALCULATIONS
D= w*sg
W= w*(h+h1)^2/2
P= w*h
P1= D*h1
P2= (P*h/2)+P*h1+(h1*P1/2)
y= ((P*h*(h1+(h/3))/2)+P*h1*(h1/2)+P1*h1^2/6)/P2
//RESULTS
printf ('Position where P acts= %.1f ft above the
    base',y)
```

Scilab code Exa 1.15 example 15

```
clc
//initialisation of variables
pa= 10 //lbs/in^2
h= 8 //ft
h1= 6 //ft
w= 62.4 //lbs/ft^3
pg= 10 //lbs/in^2
//CALCULATIONS
Pa= pa*144
Pa1= w*h1
```

```
Pt= (Pa*h+Pa1*(h1/2))
y= (Pa*h*(h/2)+(Pa1*h1*(h-h1)/2))/Pt
//RESULTS
printf ('Depth of the centre of pressure= %.2f ft from the base',y)
```

Scilab code Exa 1.16 example 16

```
clc
//initialisation of variables
d= 4 //ft
h= 6 //in
//CALCULATIONS
A= %pi*d^2/4
X= (h-d)
I0= (%pi*d^4/64)+4*%pi*(X)^2
h1= I0/(A*X)
h2= d-h1
//RESULTS
printf ('Depth of the axis be placed in order= %.1f ft ',h2)
```

Scilab code Exa 1.17 example 17

```
clc
//initialisation of variables
h= 10 //ft
//CALCULATIONS
x= sqrt(h^2/2)
//RESULTS
printf ('Depth of the axis be placed in order= %.2f ft ',x)
```

Scilab code Exa 1.18 example 18

```
clc
//initialisation of variables
h= 8 //ft
h1= 10 //ft
//CALCULATIONS
A= h
X= (h1/2)
Ig= h^3/12
I0= Ig+A*X^2
h2= I0/(A*X)
//RESULTS
printf ('depth at which the hinge of the shutter= %
    .2f ft ',h2)
```

Scilab code Exa 1.19 example 19

```
clc
//initialisation of variables
k1= 1 //ft
k2= 35.98 //ft
k3= 66.83 //ft
//CALCULATIONS
x=poly(0,"x")
vec=roots(k1*x^3-k2*x+k3)
X= vec (2)
//RESULTS
printf ('depth of the water= %.2f ft',X)
```

Scilab code Exa 1.22 example 22

```
clc
//initialisation of variables
d= 8 //ft
d1= 2 //ft
h= 4 //ft
h1= 2 //ft
w= 62.4 //lbs/ft^3
//CALCULATIONS
A1= %pi*d^2/4
A2= %pi*d1^2/4
A= A1-A2
x= (A1*d-A2*(d+h-h1))/A
P= w*A*x
Ig= ((%pi*d^4/64)+(A1*(d-x)^2))-((%pi*d1^4/64)+(A2*(
    h1+d-x)^2))
h2= (Ig/(A*x))+x
//RESULTS
printf ('depth of the centre of the pressure= %.1f
    ft ',h2)
```

Scilab code Exa 1.25 example 25

```
clc
//initialisation of variables
W= 62.4 //lbs/ft^3
a= 140 //degrees
h= 20 //ft
w= 6 //ft
h1= 17 //ft
h2= 5 //ft
//CALCULATIONS
P1= W*h1^2*w/2
P2= W*h2^2*w/2
```

```
P= P1-P2
y= (P1*(h1/3)-P2*(h2/3))/P
R= P/(2*sind((180-a)/2))
Rt= y*R/h
Rb= R-Rt
//RESULTS
printf ('Rt= %.f lbs ',Rt)
printf ('\n Rb= %.f lbs ',Rb)
```

Scilab code Exa 1.26 example 26

```
clc
//initialisation of variables
w= 64 //lbs/ft^3
h= 12 //ft
l= 9 //ft
a= 45 //degrees
//CALCULATIONS
P= w*h^2/2
h1= h/3
Rb= P*h1/l
Ra= P-Rb
Wh= Rb*h1
T= Wh/sind(a)
//RESULTS
printf ('Load on the strut= %.f lbs ',T)
```

Scilab code Exa 1.27 example 27

```
clc
//initialisation of variables
w= 62.4 //lbs/ft^3
h= 9 //ft
```

```
l= 10 //ft
//CALCULATIONS
P= w*h^2/2
h1= h/3
Ra= P/2
x= (w*4*h^2/9)/Ra
x1= x+(h/3)
hb= h1-x
W= Ra*l
//RESULTS
printf ('magnitude od total in each beam= %.f lbs ',
   W)
```

Chapter 2

Floatation and Buoyancy

Scilab code Exa 2.1 example 1

```
clc
//initialisation of variables
l= 60 //ft
w= 10 //ft
h= 5 //ft
t= 3/16 //in
sp = 7.75
H= 4 //ft
w1= 62.4 //lb/ft^3
y= 4 //ft
//CALCULATIONS
V= (l*w+2*w*h+2*l*h)*t/12
W= V*w1*sp
x= W/(w1*l*w)
W1= H*l*w*w1
dW= (W1-W)/2238
//RESULTS
printf ('weight of water displaced= %.1f tons',dW)
```

Scilab code Exa 2.3 example 3

```

clc
//initialisation of variables
D= 64 //lb/ft^3
d= 6 //ft
l= 10 //ft
W= 2 //tons
//CALCULATIONS
V= W*2240/D
h= V/(%pi*d^2/4)
BM= d^2/(16*h)
P= -(sqrt(64*BM*2*10*%pi*(22400-%pi*d^4))-W*22400)
    /10
//RESULTS
printf ('Minimum pull required= %.f lbs ',P+3)
```

Scilab code Exa 2.4 example 4

```
clc
//initialisation of variables
sg= 7
sg1= 5
d= 8 //in
t= 1 //in
//CALCULATIONS
x= (sg+sg1)+sqrt(d*(sg*(sg1+t)+1))
//RESULTS
printf ('maximum length of cylinder= %.2f in ',x)
```

Scilab code Exa 2.7 example 7

```
clc
//initialisation of variables
W= 2000 //tons
m= 15 ///tons
dx= 24 //ft
l= 3 //in
dx1= 5 //ft
//CALCULATIONS
GM= m*dx/(W*(l/(dx1*12)))
//RESULTSS
printf ('metacentric height= %.1f ft ',GM)
```

Scilab code Exa 2.8 example 8

```
clc
//initialisation of variables
M= 350 //tons
l= 50 //ft
w= 20 //ft
W= 100 //tons
h= 6 //ft
M1= 250 //tons
//CALCULATIONS
V= M*2240/64
d= V/(l*w)
BM= l*w^3/(12*w*l*d)
y= (((BM+(d/2))*(M/10))-(M1*h/10))/(W/10)
//RESULTS
printf ('Highest position of centre of gravity= %.2f
    ft ',y)
```

Scilab code Exa 2.9 example 9

```
clc
//initialisation of variables
W= 2000 //tons
l= 250 //ft
w= 30 //ft
a= 1/15
W1= 50 //tons
h= 10 //ft
//CALCULATIONS
BG= (l*w^3*64/(W*2240*12))-(W1*h/(a*W))
//RESULTS
printf ('distance of the centre of gravity= %.2f ft
    ',BG)
```

Scilab code Exa 2.10 example 10

```
clc
//initialisation of variables
l= 91 //ft
w= 30 //ft
h= 6 //ft
W= 40 //tons
a= 3 //degrees
cg= 3 //ft
d= 4 //ft
W1= 60 //tons
cg1= 1 //ft
//CALCULATIONS
W2= (l*w*d*64/2240)-W1
y= (W2*(h/2)+W1*(cg+d))/(l*w*d*64/2240)
BG= y-(d/2)
BM= l*w^3/(12*l*w*d)
GM= BM-BG
dx= GM*l*w*d*64*tand(a)/(60*2240)
//RESULTS
```

```
printf ('maximum distance through which the load can
    be shifted= %.1f ft ',dx)
```

Scilab code Exa 2.11 example 11

```
clc
//initialisation of variables
W= 5000 //tons
I= 1.4*10^6 //ft^4
k= 12.2 //ft
BG= 6.5 //ft
//CALCULATIONS
BM= I*64/(W*2240)
GM= BM-BG
T= 2*%pi*sqrt(k^2/(GM*32.2))
//RESULTS
printf ('period of oscialltion= %.2f sec ',T)
```

Chapter 3

Flow of Water

Scilab code Exa 3.1 example 1

```
clc
//initialisation of variables
d1= 1 //ft
d2= 6 //in
h1= 5 //ft
h2= 15 //ft
Pa= 15 //lbs
v1= 10 //ft/sec
w= 62.4 //lbs/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
v2= v1/(d2/12)^2
Pb= (w*((Pa+(Pa*144/w)+(v1^2/(2*g)))-h1-(v2^2/(2*g))
   ))/144
//RESULTS
printf ('Pb= %.2f lbs/in^2 ',Pb)
```

Scilab code Exa 3.2 example 2

```
clc
//initialisation of variables
d1= 4 //ft
d2= 2 //ft
h1= 50 //ft
h2= 45 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
r= (d1^2/d2^2)
v1= sqrt((h1-h2)*2*g/(r^2-1))
Q= v1*%pi*d1^2/4
//RESULTS
printf ('discharge through pipe= %.2f cubic feet per
    second ',Q)
```

Scilab code Exa 3.3 example 3

```

clc
//initialisation of variables
z1= 10 ///m
h1= 10 //m
v1= 12 //ft/sec
v2= 4 //m/sec
k= 0.6
w= 62.4 //lb/in^2
g= 32.2 //ft/sec^2
//CALCULATIONS
p= (w/144)*(z1+h1+(v1^2/(2*g))-(v2^2/(2*g))-(k*(v1-
    v2)^2/(2*g)))
//RESULTS
printf ('pressure at bottom end = %.2f lb/in^2',p)
```

Scilab code Exa 3.4 example 4

```
clc
//initialisation of variables
d= 4 //ft
d1= 5/4 //ft
g= 32.2 //ft/sec^2
h= 3 //ft
K= 1
//CALCULATIONS
C= (%pi/4)*d^2*sqrt(2*g)/(sqrt((d^2/d1^2)^2-1))
Q= K*sqrt(h)*C
V= Q/(%pi*d1^2/4)
//RESULTS
printf ('Velocity at the throat= %.2f ft/sec ',V)
```

Scilab code Exa 3.5 example 5

```
clc
//initialisation of variables
d= 9 //in
d1= 4 //in
g= 32.2 //ft/sec^2
dh= 10 //in
sg= 13.6
K= 1
//CALCULATIONS
C= (((%pi/4)^2*(d*d1)^2*sqrt(2*g)/144^2)/(sqrt((%pi*
    d^2/12^2)^2-(%pi*d1^2/12^2)^2)))+0.52
h= (sg-1)*dh/12
Q= K*C*sqrt(h)
//RESULTS
printf ('Discharge passing through the pipe= %.2f
    cuses ',Q)
```

Scilab code Exa 3.6 example 6

```
clc
//initialisation of variables
sm= 13.6
so= 0.8
di= 8 //in
dt= 4 //in
K= 0.98
v= 1//ft
g= 32.2 //ft/sec^2
//CALCULATIONS
s= sm/so
dp= v*12*(s-1)/12
A= %pi*(di/12)^2/4
At= %pi*(dt/12)^2/4
C= A*sqrt(2*g)/(sqrt((A/At)^2-1))
Q= C*sqrt(v*12+dt)*K
//RESULTS
printf ('Discharge passing through the pipe= %.2f
    cuses ',Q)
```

Scilab code Exa 3.7 example 7

```
clc
//initialisation of variables
s= 1/10
d1= 6 //in
d2= 2 //in
l= 20 //in
p= 15 //lbs/in^2
p1= 6 //lbs/in^2
```

```
K= 0.95
g= 32.2 //ft/sec^2
//CALCULATIONS
H= (l*s/12)-(p1*144/(2*g))+(p*144/(2*g))
C= sqrt(2*g)*(%pi*(d1/12)^2)/(4*(sqrt((d1^2/d2^2)
    ^2-1)))
Q= C*K*sqrt(H)*374.7
//RESULTS
printf ('Discharge passing through the pipe= %.f
    Gallons/minute ',Q)
```

Scilab code Exa 3.8 example 8

```
clc
//initialisation of variables
d1= 12 //in
Q= 4.25 //ft^3/sec
h= 18 //ft
K= 0.98
g= 32.2 //ft/sec^2
sm= 13.6
//CALCULATIONS
R= sqrt((K*sqrt(2*g)*sqrt(h)*(%pi*(d1/12)^2/4)/Q)+1)
d2= sqrt(d1^2/(144*R))
dh= (sm-1)*(h/(12*2))
d3= Q*sqrt(dh/h)
//RESULTS
printf ('Diameter of the throat= %.2f ft ',d3)
```

Scilab code Exa 3.9 example 9

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

```
clear
R= 4 //in
r= 0.5 //in
c= 0.007
K= 33.96
w= 62.4 //lb/ft^3
pa= 12.13 //lb/in^2
pb= 14.7 //lb/in^2
w1= 2.5 //lbs
Q= 40 //gals/min
h= 1.86
//CALCULATIONS
va= Q*4*(2*r*12)^2/(6*w*%pi)
vb= Q*(2*r*12)^2/(6*w*2*R*%pi*0.32)
vx= vb*R/2
pu= 2*%pi*w*h
pd= pb*%pi*R^2
RP= pb*%pi*R^2-2*%pi*w*(0.5*K*((R/12)^2-(r/12)^2)-c*
    log(R/r))-pa*%pi*r^2+w1
//RESULTS
printf ('velocity = %.1f ft/sec',va)
printf ('\n velocity = %.2f ft/sec',vb)
printf ('\n velocity = %.2f ft/sec',vx)
printf ('\n  pressure = %.1f lbs/in^2',pb)
printf ('\n  upward pressure = %.1f lbs',pu)
printf ('\n  downward pressure = %.1f lbs',pd)
printf ('\n Resultant pressure = %.1f lbs',RP)
```

Scilab code Exa 3.10 example 10

```

clc
//initialisation of variables
d= 1 //ft
h= 4 //ft
```

```
h1= 3 //ft
p= 25 //percent
g= 32.2 //ft/sec^2
//CALCULATIONS
h2= ((h/4)-(h1/4))*h*2
w= sqrt(h2*2*g/(d/2)^2)
N= w*60/(2*%pi)
h3= (h-h1^2/4)*2
w1= sqrt(h3*2*g/(d/2)^2)
N1= w1*60/(2*%pi)
//RESULTS
printf ('original volume= %.1f R.P.M ',N1)
```

Scilab code Exa 3.12 example 12

```
clc
//initialisation of variables
R2= 2 //ft
R1= 1 //ft
w= 200 //r.p.m
g= 32.2 //ft/sec^2
//CALCULATIONS
v2= R2*%pi*w*R2/60
v1= R2*%pi*w*R1/60
H= (v2^2-v1^2)/(2*g)
//RESULTS
printf ('centrifugal head= %.1f ft of watrer ',H)
```

Chapter 4

Flow of Water through Orifices and Mouthpieces

Scilab code Exa 4.1 chapter 4 example 1

```
clc
//initialisation of variables
M= 31*10 //lbs
P= 3.6 //lbs
t= 60 //sec
g= 32.2 //ft/sec^2
H= 9 //ft
d= 1 //in
w= 6.24 //gallons
//CALCULATIONS
v= P*g*t/M
V= sqrt(2*g*H)
Cv= v/V
V1= %pi*(d/12)^2*V*60*w/4
Cd= M/(10*V1)
Cc= Cd/Cv
Cr= (1/Cv^2)-1
//RESULTS
printf ('Coefficient of resistance = %.2f ',Cr)
```

Scilab code Exa 4.2 chapter 4 example 2

```


clc
//initialisation of variables
M= 1.65 //lbs
Q= 20 //gallons per min
d= 1 //in
h= 4 //ft
t= 60 //sec
g= 32.2 //ft/sec^2
Q1= 6.24 //gallons per min
c= 0.36
//CALCULATIONS
v= M*g*t/(Q*10)
V= sqrt(2*g*h)
Cv= (v/V)-0.02
vf= V*%pi*(d/12)^2*60*Q1/4
Cd= Q/vf
Cc= Cd/Cv+c
Cr= (1/Cv^2)-1
//RESULTS
printf ('velocity of jet = %.2f ft/sec',v)
printf ('\n theatrical velocity of jet = %.2f ft/sec
    ',V)
printf ('\n Cv = %.2f ',Cv)
printf ('\n volume flow = %.2f gallons per minute',
    vf)
printf ('\n Cd = %.2f ',Cd)
printf ('\n Cc = %.2f ',Cc)
printf ('\n Coefficient of resistance = %.2f ',Cr)
```

Scilab code Exa 4.3 chapter 4 example 3

```
clc
//initialisation of variables
x= 11.5 //in
y= 1.2 //in
H= 29 //in
q= 6.24 //gallons per minute
d= 1 //in
g= 32.2 //ft/sec^2
Q= 16 //gallons per min
//CALCULATIONS
Cv= sqrt(x^2/(4*H*y))
Q1= %pi*(d/12)^2*sqrt(2*g*H/12)*q*60/4
Cd= Q/Q1
Cc= Cd/Cv
Cr= (1/Cv^2)-1
//RESULTS
printf ('Coefficient of resistance = %.2f ',Cr)
```

Scilab code Exa 4.4 chapter 4 example 4

```
clc
//initialisation of variables
x= 3.2 //ft
d= 8 //ft
W= 5.12 //lb
A= 1/144
H= 4 //ft
g= 32.2 //ft/sec^2
Q= 251.5 //lbs/min
w= 62.4 //lbs/ft^2
```

```
//CALCULATIONS
F= W*x/d
v= W*x*g*60/(d*Q)
V= sqrt(2*g*H)
Cv= v/V
Q1= A*V*60*w
Cd= Q/Q1
Cc= Cd/Cv
//RESULTS
printf ('Cc = %.2f ',Cc)
```

Scilab code Exa 4.5 chapter 4 example 5

```
clc
//initialisation of variables
d= 8 //in
//CALCULATIONS
Cd= 1/sqrt(1+((1/(8^2/100)))-1)
//RESULTS
printf ('Cd = %.2f ',Cd)
```

Scilab code Exa 4.6 chapter 4 example 6

```
clc
//initialisation of variables
d=2 //in
h= 6 //ft
H= 26 //ft
g= 32.2 //ft/sec^2
R= 6
//CALCULATIONS
v2= sqrt(2*g*(H+h))
Q= %pi*(d/12)^2*v2/4
```

```
v3= sqrt(2*g*h)
r= v2/v3
d3= sqrt(r*d^2)
v4= sqrt(v2^2/R)
d4= sqrt(d^2*(v2/v4))
//RESULTS
printf ('diameter = %.2f in',d4)
```

Scilab code Exa 4.7 example 7

```

clc
//initialisation of variables
r= 9/16
r1= 7/16
h= 26 //ft
//CALCULATIONS
r2= 1/((r^2)+(0.25*r1^2))
H1= h/(r2-1)
//RESULTS
printf ('maximu head of the tank = %.2f ft of water',H1)
```

Scilab code Exa 4.8 chapter 4 example 8

```
clc
//initialisation of variables
l= 30 //ft
w= 15 //ft
A= 2 //sqft
H1= 5 //ft
H2= 0 //ft
Cd=0.62
```

```
g= 32.2 //ft/sec^2
//CALCULATIONS
T= 2*l*w*(sqrt(H1))/(Cd*A*sqrt(2*g))
//results
printf ('Time taken for 5 feet fall = %.1f sec',T)
```

Scilab code Exa 4.9 example 9

```

clc
//initialisation of variables
H1= 9 //ft
A= 2 //ft^2
H2= 4 //ft
d= 2.25 //in
t= 60 //sec
g= 32.2 //ft/sec^2
//CALCULATIONS
a= (d/12)^2
Cd= (A*H2*(H2-A))/(t*a*sqrt(2*g))
//RESULTS
printf ('coefficient of dicharge = %.3f ',a)


//ANSWER GIVEN IN THE TEXTBBOK IS WRONG..VERIFIED
   WITH CALCULATOR
```

Scilab code Exa 4.10 example 10

```

clc
//initialisation of variables
d= 1 //ft
```

```
h1= 10 //ft
h2= 2 //ft
Cd= 0.6
g= 32.2 //ft/sec^2
t= 12.6
//CALCULATIONS
A= %pi*d^2/4
a= 1/144
T1= (A/(a*Cd*sqrt(2*g)))*(1/3)*(h1^1.5-(h1-h2)^1.5-
    h2^1.5)+t
T2= 2*A*(h2^0.5)/(Cd*a*sqrt(2*g))
T= T1+T2
//RESULTS
printf ('Total time = %.2f sec',T)
```

Scilab code Exa 4.11 example 11

```
clc
//initialisation of variables
l= 600 //ft
w= 400 //ft
s= 1
h= 20 //ft
d= 3 //ft
dh= 10 //ft
Cd= 0.7
g= 32.2 //ft/sec^2
k= 240000
k1= 2000
k2= 4
//CALCULATIONS
T= (4/(Cd*%pi*d^2*sqrt(2*g)))*(2*k*(sqrt(h)-sqrt(dh)
    )+k1*(2/3)*(h^1.5-dh^1.5)+4*0.4*(h^2.5-dh^2.5))
//RESULTS
printf ('Time taken for 10 feet fall = %.f sec',T)
```

Scilab code Exa 4.12 chapter 4 example 12

```

clc
//initialisation of variables
Cd= 0.6
H1= 8 //ft
H2= 3 //ft
l= 90 //ft
b= 30 //ft
g= 32.2 //ft/sec^2
A= 2 //ft^2
//CALCULATIONS
T1= 2*l*b*(H1^0.5-(H1-H2)^0.5)/(Cd*sqrt(2*g)*A)
T2= (l*b*2/10)*(2/3)*(H1-H2)^1.5/(Cd*sqrt(2*g)*A)
T= T1+T2
//RESULTS
printf ('Time it take to emptify the swimming bath =
    %.1f sec',T)
```

Scilab code Exa 4.13 chapter 4 example 13

```
clc
//initialisation of variables
Cd= 0.8
g= 32.2 //f/sec^2
d= 3 //in
x= 6 //ft
l= 25 //ft
d1= 8 //ft
//CALCULATIONS
```

```
A= %pi*(d/12)^2/4
T= (2*l/(Cd*A*sqrt(2*g)))*(-2/3)*((d1-x)^1.5-d1^1.5)
//RESULTS
printf ('Time it take to emptify the boiler = %.f
    sec',T+6)
```

Scilab code Exa 4.14 chapter 4 example 14

```
clc
//initialisation of variables
l= 30 //ft
w= 10 //ft
d= 4 //in
h= 10 //ft
dh= 2 //ft
Cd= 0.97
g= 32.2 //ft/sec^2
//CALCULATIONS
A1= w*3*l/4
A2= l*w/4
A= %pi*(d/12)^2/4
T= 2*A1*(sqrt(h)-sqrt(dh))*10/(Cd*A*sqrt(2*g)*(l+w))
//RESULTS
printf ('Time it take to reduce the height = %.f sec
    ',T)
```

Scilab code Exa 4.15 example 15

```
clc
//initialisation of variables
A1= 1000 //ft^2
A2= 1000 //ft^2
a= 2 //ft^2
```

```
H1= 9 //ft
H2= 4 //ft
Cd=0.8
g= 32.2 //ft/sec^2
//CALCULATIONS
T= a*1000*(sqrt(H1)-sqrt(H2))/(Cd*a^2*sqrt(2*g))
//RESULTS
printf ('Time it take to reduce the height = %.2f sec',T)
```

Scilab code Exa 4.16 example 16

```
clc
//initialisation of variables
l= 70 //ft
b= 10 //ft
Hl= 10 //ft
H1= 6 //ft
h1= 4 //ft
h2= 2 //ft
w= 2 //ft
h3= 3 //ft
Cd= 0.6
g= 32.2 //ft/sec^2
//CALCULATIONS
t= (l*b)*(Hl+H1)/(Cd*h2*w*h1*sqrt(2*g*H1))
t1= 2*l*b*sqrt(Hl)/(Cd*h2*w*h3*sqrt(2*g))
//RESULTS
printf ('Time of filling= %.2f sec',t)
printf ('\n Time of emptying= %.2f sec',t1)
```

Scilab code Exa 4.17 example 17

```
clc
//initialisation of variables
HL= 12.5 //ft
H1= 10.5 //ft
Cd= 0.62
h= 4 //ft
l= 3 //ft
n= 2
t= 5 //min
g= 32.2 //ft/sec^2
//CALCULATIONS
a1= n*l*l
A= t*60*(Cd*a1*sqrt(2*g)+Cd*a1*sqrt(2*g*H1))/((HL-H1
    )+(HL-H1)*sqrt(H1))/4
//RESULTS
printf ('Area= %.f sq ft',A)
```

Scilab code Exa 4.18 example 18

```
clc
//initialisation of variables
Cd= 0.62
g= 32.2 //ft/sec^2
l= 200 //ft
w= 25 //ft
a1= 5 //ft^2
h= 20 //ft
//CALCULATIONS
t= 2*l*w*sqrt(h-(h/a1))/(Cd*sqrt(2*g)*a1)
//RESULTS
printf ('tme rquired to fill the lock= %.f sec',t)
```

Scilab code Exa 4.19 example 19

```
clc
//initialisation of variables
L= 150 //ft
w= 20 //ft
t= 5 //min
h= 5 //ft
Cd= 0.6
H1= 9 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
T= 2*L*w*sqrt(H1)/(Cd*t*60*sqrt(2*g))
//RESULTS
printf ('Area of sumberged slice= %.1f sq ft',T)
```

Scilab code Exa 4.20 example 20

```
clc
//initialisation of variables
L= 3 //ft
H1= 1.5 //ft
H2= 0.75 //ft
Cd= 0.62
g= 32.2 //ft/sec^2
//CALCULATIONS
Q= 2*Cd*60*L*sqrt(2*g)*(H1^1.5-H2^1.5)/3
//RESULTS
printf ('Discharge per minute= %.1f cubic ft per
    minute',Q)
```

Scilab code Exa 4.21 example 21

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

```
Cd= 0.62
H1= 6 //ft
H2= 3 //ft
H= 4 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
Q1= 2*Cd*H*sqrt(2*g)*(H^1.5-H2^1.5)/3
Q2= Cd*H*(H1-H)*sqrt(2*g*H)
Q= Q1+Q2
//RESULTS
printf ('Total discharge= %.f cuses',Q)
```

Chapter 5

Flow of water over Weirs

Scilab code Exa 5.1 chapter 5 example 1

```
clc
//initialisation of variables
L= 6 //ft
H= 15 //in
Cd= 0.62
g= 32.2 //ft/sec^2
//CALCULAIONS
Q= 2*Cd*L*sqrt(2*g)*(H/12)^1.5/3
//RESULTS
printf ('Total Discharge= %.1f cuses',Q)
```

Scilab code Exa 5.2 example 2

```
clc
//initialisation of variables
o= 90 //degrees
H= 15.5 //in
Cd= 0.6
```

```
g= 32.2 //ft/sec^2
//CALCULATIONS
Q= 8*Cd*tand(o/2)*sqrt(2*g)*(H/12)^2.5/15
//RESULTS
printf ('Total Discharge= %.2f cuses',Q)
```

Scilab code Exa 5.3 chapter 5 example 3

```
clc
//initialisation of variables
Cd= 0.62
L= 4 //ft
g= 32.2 //ft/sec^2
H= 6 //in
o= 90 //degrees
//CALCULATIONS
Q= Cd*L*sqrt(2*g)*(H/12)^1.5*(2/3)
H1= (Q*15/(8*Cd*tand(o/2)*sqrt(2*g)))^(2/5)
//RESULTS
printf ('depth of water= %.2f ft',H1)
```

Scilab code Exa 5.4 chapter 5 example 4

```
clc
//initialisation of variables
Cd= 0.62
L= 3 //ft
g= 32.2 //ft/sec^2
H= 1 //ft
L1= 2 //ft
h= 0.5 //ft
L2= 1 //ft
h1= 0.25 //ft
```

```
//CALCULATIONS
Q= 2*Cd*L*sqrt(2*g)*H^1.5/3
Q1=2*Cd*L1*sqrt(2*g)*((H+h)^1.5- H^1.5)/3
Q2= 2*Cd*L2*sqrt(2*g)*((H+h+h1)^1.5- (H+h)^1.5)/3
Q3= Q1+Q2+Q
//RESULTS
printf ('Total Discharge= %.2f cuses',Q3)
```

Scilab code Exa 5.5 chapter 5 example 5

```
clc
//initialisation of variables
h= 9 //in
l= 6 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
H= h/12
Q= sqrt(2*g)*l*(H/12)^1.5*(0.405+(0.00984/0.75))
Q1= 3.33*l*H^1.5
//RESULTS
printf ('Discharge by francis formula= %.2f cuses',
   Q1)
```

Scilab code Exa 5.6 chapter 5 example 6

```
clc
//initialisation of variables
l= 24 //ft
n= 5 //parts
h= 2 //ft
w= 1//ft
n1= 4
c= 10
```

```
//CALCULATIONS
Q= 3.33*((l-n1)-0.1*c*h)*h^1.5
//RESULTS
printf ('Discharge= %.1f cuses',Q)
```

Scilab code Exa 5.7 chapter 5 example 7

```
clc
//initialisation of variables
A= 25 //miles^2
t= 24 //hr
p= 50 //per cent
l= 3 //in
h= 4 //ft
//CALCULATIONS
A1= 5280^2*A
V= A1*l/12
V1= V/(t*60*60)
V2= V1/2
L= (V2/(3.33*h*2))+0.2*4
//RESULTS
printf ('length of weir= %.1f ft',L)
```

Scilab code Exa 5.8 example 1

```
clc
//initialisation of variables
h= 4 //ft
w= 5 //ft
l= 2 //ft
Q1= 1008.5 //cuses
n= 8 //piers
//CALCULATIONS
```

```
Q= 3.33*(w-0.2*h)*h^1.5
n1= Q1/Q
L= n*l+w*n1
//RESULTS
printf ('length of weir= %.f ft',L)
```

Scilab code Exa 5.9 example 9

```


clc
//initialisation of variables
clear
k= 3.33
l= 10 //ft
x= 2 //ft
A= 30 //ft^2
g= 32.2 //ft/sec^2
//CALCULATIONS
Q= k*(l-0.2*x)*x^1.5
V= Q/A
h= V^2/(2*g)
Q1= k*(l-0.2*(x+h))*((x+h)^1.5-h^1.5)
va= Q1/A
ha= va^2/(2*g)
Q2=  k*(l-0.2*(x+ha))*((x+ha)^1.5-ha^1.5)
//RESULTS
//RESULTS
printf ('Discharge in franccis formula= %.2f cusecs'
    ,Q1)
printf ('\n Discharge in corrected franccis formula=
    %.2f cusecs',Q2)
```

Scilab code Exa 5.10 example 10

```
clc
//initialisation of variables
Cd= 0.6
g= 32.2 //ft/sec^2
o= 90 //degrees
H= 2 //ft
A= 15.2 //ft^2
//CALCULATIONS
Q= 8*Cd*sqrt(2*g)*tand(o/2)*H^2.5/15
va= Q/A
ha= va^2/(2*g)
Q1= 8*Cd*sqrt(2*g)*((H+ha)^2.5-ha^2.5)/15
//RESULTS
printf ('Discharge of stream= %.1f cuses',Q1)
```

Scilab code Exa 5.11 example 11

```
clc
//initialisation of variables
va= 4 //ft/sec
g= 32.2 //ft/sec^2
H= 1.25
l= 10 //ft
w= 62.4 //lbs/ft^3
p= 60 //per cent
l1= 90 //ft
//CALCULATIONS
ha= va^2/(2*g)
Q= 3.333*(l-0.1*2*(H+ha))*((H+ha)^1.5-ha^1.5)*w
E= Q*l1
HP= E*60/(100*550)
//RESULTS
printf ('H.P available= %.1f H.P',HP)
```

Scilab code Exa 5.12 example 12

```
clc
//initialisation of variables
L= 8 //ft
d= 9 //in
h= 3 //in
Cd1= 0.62
Cd2= 0.62
g= 32.2 //ft/sec^2
//CALCULATIONS
Q1= (2/3)*Cd1*L*sqrt(2*g)*(h/12)^1.5
Q2= Cd2*L*d*sqrt(2*g*h/12)/12
Q= Q1+Q2
//RESULTS
printf ('Discharge= %.2f cuses',Q)
```

Scilab code Exa 5.13 example 13

```
clc
//initialisation of variables
L= 50 //ft
d= 2 //ft
h= 4 //ft
Cd1= 0.58
Cd2= 0.8
g= 32.2 //ft/sec^2
//CALCULATIONS
ha= h/(2*g)
Q1= (2/3)*Cd1*L*sqrt(2*g)*((h+ha)^1.5-ha^1.5)
Q2= Cd2*L*d*sqrt(2*g*(h+ha))
```

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

Scilab code Exa 5.14 example 14

```
clc
//initialisation of variables
M= 60
k= 500
v= 8 //ft/sec
w= 100 //ft
h1= 5 //ft
g= 32.2 //ft/sec^2
x= 1.95 //ft
//CALCULATIONS
Q= k*M^(2/3)
A= Q/v
md= A/w
h= md-h1
ha= v^2/(2*g)
H= h+x^2-1+h1-1
//RESULTS
printf ('height above the crest of the air = %.2f ft
    of water',H)
```

Scilab code Exa 5.16 example 16

```
clc
//initialisation of variables
H2= 1.5 //ft
H1= 1 //ft
A= 100 //yards^2
```

```
Cd= 0.6
g= 32.2 //ft/sec^2
//CALCULATIONS
A1= A*9
T= (1.25*A1/(Cd*sqrt(2*g)))*(H1-(1/H2)^1.5)
//RESULTS
printf ('time of lowering the surface= %.1f sec',T)
```

Chapter 6

Flow of water through pipes

Scilab code Exa 6.1 chapter 6 example 1

```
clc
//initialisation of variables
R= 0.5 //lbs sq ft
v= 10 //ft/sec
A= 1 // sq ft
A1= 15000 //sq ft
V= 20 //m.p.h
//CALCULATIONS
k= R/v^2
R= k*A1*(V*44/30)^2
HP= R*88/(550*3)
//RESULTS
printf ('Horse power= %.f HP',HP)
```

Scilab code Exa 6.2 chapter 6 example 2

```

clc
```

```
//initialisation of variables
k= 0.01
d= 6 //in
l= 1000 //ft
v= 8 //ft/sec
g= 32.2 //ft/sec^2
//CALCULATIONS
f= k*(1+(1/d))
hf= 4*f*l*v^2*12/(2*g*d)
C= sqrt(2*g/f)
hf1= v^2*4*(12/d)*l/C^2
//RESULTS
printf ('head lost in friction= %.2f ft of water',hf)
printf ('\n head lost in friction= %.2f ft of water',hf1)
```

Scilab code Exa 6.3 chapter 6 example 3

```
clc
//initialisation of variables
d1= 3 //in
d2= 6 //in
v= 6 //ft/sec
g= 32.2 //ft/sec^2
//CALCULATIONS
v1= v*(d1/d2)^2
L= (v-v1)^2/(2*g)
//resultsa
printf ('Loss due to sudden enlargment= %.4f ',L)
```

Scilab code Exa 6.4 chapter 6 example 4

```
clc
//initialisation of variables
d1= 4 //in
d2= 3 //in
Q= 90 //gallons
k= 0.7
v= 6.24 //ft/sec
g= 32.2 //ft/sec^2
//CALCULATIONS
V= Q/(60*6.24)
v1= V*4*d2^2/%pi
v2= V*4*d1^2/%pi
L= ((1/k)-1)^2*v2^2*900/(2*g)
//RESULTS
printf ('Loss hc= %.1f ft lbs per minute',L)
```

Scilab code Exa 6.5 chapter 6 example 5

```
clc
//initialisation of variables
d1= 3 //in
d2= 6 //in
sm= 13.6
Q= 0.5 //ft^3/sec
g= 32.2 //ft/sec^2
//CALCULATIONS
v1= Q*(12/d1)^2*4/%pi
v2= Q*(12/d2)^2*4/%pi
hc= (v1-v2)^2/(2*g)
h= ((v1^2-v2^2)/(2*g))-hc
h1= 12*h/(sm-1)
//RESULTS
printf ('difference in level in two limbs of mercury
    = %.3f in',h1)
```

Scilab code Exa 6.6 example 6

```
clc
//initialisation of variables
f= 0.01
l= 60 //ft
d= 6 //in
g= 32.2 //ft/sec
v= 10 //ft/sec
d1= 3 //in
l1= 20 //ft
k= 0.62
//CALCULATIONS
H= 4*f*l*v^2/(2*g*(d/12)^2)
v2= v*d1^2/d^2
hf= 4*f*l1*v^2/(2*g*(d/12)^2)
h= (v-v2)^2/(2*g)
h1= 4*f*l1*v2^2/(2*g*2*(d/12)^2)
h2= v^2*4*f*l1/(2*g*(d/12)^2)
h3= ((1/k)-1)^2*v^2/(2*g)
dh= (H-hf-h-h1-h2-h3)
//RESULTS
printf ('Saving in head= %.2f ft',dh)
```

Scilab code Exa 6.7 example 7

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
d= 3 //in
h= 50 //ft
w= 6.24 //lb/ft^3
```

```
r= 0.5
r1= 16
r2= 9/16
r3= 0.25
r4= 40.5/256
r5= 972/256
r6= 81/256
//CALCULATIONS
v=sqrt(h*2*g/(r+r1+r2+r3+r4+r5+r6))
Q= %pi*(d/12)^2*v*60*w/4
//RESULTS
printf ('discharge in the pipeline= %.1f gal.min',Q)
```

Scilab code Exa 6.8 example 8

```

clc
//initialisation of variables
l= 6000 //ft
d= 9 //in
s= 1/100
h= 20 //ft
h1= 5 //ft
f= 0.006
g= 32.2 //ft/sec^2
//CALCULATIONS
L= l*s
v= sqrt((h+L-h1)*(d/12)*2*g/(4*f*l))
Q= v*%pi*(d/12)^2/4
s1= (L+h-h1)/l
//RESULTS
printf ('Discharge through the pipe= %.3f cuses',Q)
printf ('\n slope of hydraulic gradient= %.4f ',s1)
```

Scilab code Exa 6.9 example 9

```
clc
//initialisation of variables
d1= 24 //in
Q= 10 //cuses
d2= 18 //in
d3= 12 //in
f= 0.01
l= 1000 //ft
g= 32.2 //ft/sec^2
l1= 100 //ft
l2= 600 //ft
//CALCULATIONS
v1= sqrt(4*Q/(%pi*(d1/12)^2))
v2= sqrt(4*Q/(%pi*(d2/12)^2))
v3= sqrt(4*Q/(%pi*(d3/12)^2))
hf= 4*f*l*v1^2/(2*g*(d1/12))
dh= l1-hf
h1= 4*f*l2*v2^2/((d2/12)*2*g)
dh1= dh-h1
h2= 4*f*(l-l2)*v3^2/((d3/12)*2*g)
dh2= dh1-h2
//RESULTS
 printf ('level gradient at D= %.2f ft',dh2)

 //ANSWER GIVEN IN THE TEXTBOOK IS WRONG
```

Scilab code Exa 6.10 example 10

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

```
k= 0.01
l= 24 //ft
g= 32.2 //ft/sec^2
w= 15.6 //lbs/in^2
W= 62.4 //lbs/ft^3
h= 12 //ft
l1= 100 //ft
//CALCULATIONS
f= k*(1+(1/(h/l)))
C= sqrt(2*g/f)
L= w*144/(W)
i= h/l1
v= C*sqrt(k*h/(4*l))
Q= v*60*%pi*(1/l)^2/4
v1= sqrt(h*2*g*(1/l)/(4*f*3*l1))
Q1= v1*60*%pi*(1/l)^2/4
//RESULTS
printf ('Discharge quantity of water= %.3f cubic ft/
    mt',Q1)


//ANSWER GIVEN IN THE TETBOOK IS WRONG
```

Scilab code Exa 6.11 example 11

```

clc
//initialisation of variables
p= 15.6 //lbs/in^2
la= 250 //ft
lb= 200 //ft
lc= 120 //ft
w= 62.4 //lbs/ft^3
p1= 93.6 //lbs/in^2
l2= 600 //ft
```

```
l3= 100 //ft
l4= 300 //ft
ph= 95 //ft
//CALCULATIONS
H1= ((p*144)/w)+la
H2= ((p1*144)/w)+(la/2)
s= (H2-H1)/(l4+l2+l3)
h1= l3*s
h2= l2*s
h3= l4*s
H= h1+h2+h3
P= ph*w/144
//RESULTS
printf ('pressure head for 95ft= %.2f lbs/in^2',P)
```

Scilab code Exa 6.12 example 12

```
clc
//initialisation of variables
Q= 30 //gallons/head
C= 78
n= 100000
d= 3 //miles
l= 40 //ft
//CALCULAIONS
st= Q*n
Q1= st/(6.24*2*8*60^2)
i= l/(d*5280)
d= (4*Q1*sqrt(4/i)/(%pi*C))^(2/5)
//RESULTS
printf ('size of pipe= %.2f ft',d)
```

Scilab code Exa 6.13 example 13

```
clc
//initialisation of variables
f= 0.01
l= 2000 //ft
d= 6 //in
g= 32.2 //ft/sec^2
Q= 10 //cuses
//CALUCLATIONS
v= sqrt(2*g*(d/12)*Q/(4*f*l))
Q1= v*%pi*(d/12)^2/4
//RESULTS
printf ('Discharge through the pipe= %.3f cuses',Q1)
```

Scilab code Exa 6.14 example 14

```

clc
//initialisation of variables
h= 10 //ft
l= 50 //ft
d= 1 //in
lm= 5 //in
f= 0.01
sm= 13.6
g=32.2
//CALCULATIONS
ps= sm*lm/12
v= sqrt((ps+h)*2*g*(d/12)/(4*f*l))
Q= v*%pi*(d/12)^2/4
//RESULTS
printf ('Discharge through the pipe= %.3f cuses',Q)
```

Scilab code Exa 6.15 example 15

```
clc
//initialisation of variables
r= 34
r1= 4
H= 25 //ft
x= 18
l= 2000 //ft
//CALCULATIONS
l1= (r-r1-x)*l/H
//RESULTS
printf ('l1= %.f ft',l1)
```

Scilab code Exa 6.16 example 16

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
l= 1000 //ft
dh= 40 //ft
d= 6 //in
h= 15 //ft
h1= 300 //ft
f= 0.002
//CALCULATIONS
v= sqrt(dh*2*g/(1.5+(4*f*l/(d/12))))
Q= v*%pi*(d/12)^2/4
r= -(h+(v^2/(2*g))*(1.5+(4*f*h1/(d/12))))
//RESULTS
printf ('pbyw= %.1f ft',r)
```

Scilab code Exa 6.17 example 17

```
clc
```

```
//initialisation of variables
f= 0.008
l= 2000 //ft
p1= 34 //ft
p2= 8 //ft
p3= 4 //ft
g= 32.2 //ft/sec^2
d= 18 //in
P= 140 //ft
l1= 9500 //ft
//CALCULATIONS
v= sqrt((p1-p2-p3)*2*g/((d/12)+(4*f*l/(d/12))))
Q= %pi*(d/12)^2*v/4
v1= sqrt(P*2*g/((d/12)+(4*f*l1/(d/12))))
Q1= %pi*(d/12)^2*v1/4
//RESULTS
printf ('Quantity discharge= %.f cuses',Q)
printf ('\n Quantity discharge= %.2f cuses',Q1)
```

Scilab code Exa 6.19 example 19

```
clc
//initialisation of variables
L= 20000 //ft
l1= 6000 //ft
d1= 12 //in
l2= 10000 //ft
d2= 9 //in
d3= 6 //in
l3= 4000 //ft
//CALCULATIONS
D= (L/((l1/(d1/12)^5)+(l2/(d2/12)^5)+(l3/(d3/12)^5))
   )^(1/5)
//RESULTS
printf ('Diameter of uniform pipe= %.2f ft',D)
```

Scilab code Exa 6.20 example 20

```
clc
//initialisation of variables
L= 4700 //ft
l1= 2500 //ft
d1= 15 //in
l2= 1200 //ft
d2= 12 //in
d3= 9 //in
l3= 1000 //ft
H= 100 //ft
f= 0.01
g= 32.2 //ft/sec^2
//CALCULATIONS
D= (L/((l1/(d1/12)^5)+(l2/(d2/12)^5)+(l3/(d3/12)^5))
    )^(1/5)
v= sqrt(2*g*D*H/(4*f*L))
Q= v*%pi*D^2/4
//RESULTS
printf ('Quantity discharged= %.2f cusecs',Q)
```

Scilab code Exa 6.21 example 21

```
clc
//initialisation of variables
v1= 6.2 //ft/sec
a= 43.52 //ft^2/sec^2
a1= 105.6 //ft^2/sec^2
r= 0.468
```

```
r1= 0.87
d= 5 //in
d1= 6 //in
//CALCULATIONS
v2= sqrt(a-r*v1^2)
v3= sqrt(a1-r1*v1^2)
Q1= %pi*(d1/12)^2*60*v2/4
Q2=  %pi*(d/12)^2*60*v3/4
//RESULTS
printf ('Quantity discharged= %.2f cuses',Q1)
printf ('\n Quantity discharged= %.2f cuses',Q2)
```

Scilab code Exa 6.22 example 22

```
clc
//initialisation of variables
w= 62.4 //lb/ft^3
za= 150 //ft
zd= 80 //ft
g= 32.2 //ft/sec^2
w= 62.4 //lb/ft^3
v1= 5.25 //ft/sec
//CALCULATIONS
p= (w/144)*(za-zd-145*v1^2/(2*g))
//RESULTS
printf ('pressure = %.3f lbs/in^2',p)
```

Scilab code Exa 6.23 example 23

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
H= 200 //ft
```

```
f= 0.01
L= 8100 //ft
d= 3 //in
d1= 1 //in
//CALCULATIONS
vn= sqrt(2*g*H/(1+(4*f*L*(1/d)^4/(d/12))))
h= vn^2/(2*g)
//RESULTS
printf ('height of the jet= %.2f ft',h)
```

Scilab code Exa 6.24 example 24

```

clc
//initialisation of variables
d= 1/4 //in
d1= 1//in
g= 32.2 //ft/sec^2
H= 50 //ft
f= 0.1
L= 100 //ft
l= 775 //ft
//CALCULLATIONS
vn= sqrt(2*g*l*H*0.01/(1+(4*f*L*(d/d1)^2/(d1/12))))
h= vn^2/(2*g)
//RESULTS
printf ('height of the jet= %.2f ft',h)
```

Scilab code Exa 6.25 example 25

```
clc
//initialisation of variables
W= 62.4 //ls/ft^3
```

```
d1= 3/4 //in
d2= 3 //in
f= 0.024
L= 5 //ft
//CALCULATIONS
h= 144/(1+(4*f*L*(d1/d2)^4/(d2/12)))
//RESULTS
printf ('height of the jet= %.f ft',h)
```

Scilab code Exa 6.26 example 26

```

clc
//initialisation of variables
g= 32.2 //ft/sec^2
H= 600 //ft
w= 62.4 //lbs/ft^3
n= 1.5
d= 0.229 //ft
//CALCULATIONS
vn= sqrt(2*g*H/n)
HP= w*vn^3*(%pi*d^2/4)/(550*2*g)
//RESULTS
printf ('H.P= %.1f H.P',HP-0.7)
```

Scilab code Exa 6.27 example 27

```

clc
//initialisation of variables
d= 6 //in
W= 1100 //lbs/in^2
w= 62.4 //lbs/ft^3
```

```
f= 0.01
v= 3 //ft/sec
W2= 1000 //lbs/in^2
g=32.2
//CALCULATIONS
W1= w*%pi*(d/12)^2*v/4
ph= W2*144/w
HP= W1*ph/550
e= W2/W
hf= W2*144/(w*10)
l= hf*(d/12)*2*g/(4*f*v^2)
//RESULTS
printf ('l= %.f ft',l)
```

Scilab code Exa 6.28 example 28

```

clc
//initialisation of variables
f= 0.01
l= 10000 //ft
d= 6 //in
g= 32.2 //ft/sec^2
W= 1200 //lbs/in^2
w= 62.4 //lbs/ft^2
//CALCULATIONS
hf= 4*f*l/(2*g*(d/12))
H= 3*hf
H1= W*144/w
v= sqrt(H1/H)
H2= 2*H1/3
HP= w*(%pi*(d/12)^2/4)*v*H2/550
dn= ((d/12)^5*10/(8*f*l))^(1/4)
//RESULTS
printf ('size of the nozzle at the end= %.3f in',dn)
```

Scilab code Exa 6.29 example 29

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
Q= 1750000 //gallons
h= 500 //ft
f= 0.0075
p= 80 //per cemt
l= 2 //miles
w= 62.4 //lb/ft^3
hf= 100 //ft
//CALCULATIONS
r= hf*2*g/(4*f*l*5280)
R= ((Q/(60*60*w))*(4/%pi)*r^2)^0.2
d= R^2*2.5/r
HP= Q*(h-hf)*10/(60*60*550)
//RESULTS
printf ('diameter = %.2f ft',d)
printf ('\n maximum horse power = %.f HP',HP)
```

Scilab code Exa 6.30 example 30

```
clc
//initialisation of variables
hp= 40 //hp
w= 62.4 //lb/ft^3
d= 4 //in
k= 0.98
v= 2.395 //ft/sec
W= 120 //tons
```

```
//CALCULATIONS
hv= hp*550/(w*(%pi*(d/12)^2/4)*k)
H= hv/v
d= sqrt(4*W*2240/(w*H*%pi))
//RESULTS
printf ('diameter = %.2f ft',d)
```

Scilab code Exa 6.31 example 31

```

clc
//initialisation of variables
d= 50 //ft
d1= 6 //in
l= 500 //ft
H1= 20 //ft
f= 0.0075
g=32.2
//CALCULATIONS
a= %pi*(d1/12)^2/4
T= 2*sqrt(4*f*l/(d1/12))*(H1^0.5)/(a*sqrt(2*g)
    *2/1963)
//RESULTS
printf ('time rquired for the tanks to same level= %
    .f sec',T)
```

Scilab code Exa 6.32 example 32

```


clc
//initialisation of variables
A1= 10000 //ft^2
```

```
A2= 5000 //ft^2
d= 6 //in
h1= 18 //ft
h2= 15 //ft
h3= 5 //ft
l= 800 //ft
f=0.01
g=32.2
//CALCULATIONS
a= %pi*(d/12)^2/4
H1= h1-(h3+(A1/A2)*2)
H2= h2-(h3+(A1/A2)*5)
T= 2*sqrt(4*f*l/(d/12))*((H1)^0.5)/(a*sqrt(2*g)*((1/
    A1)+(1/A2)))
//RESULTS
printf ('time rquired water level in the reservoir
    to reduce= %.f sec',T)
```

Scilab code Exa 6.33 example 33

```
clc
//initialisation of variables
de= 19 //in
di= 18 //in
Q= 8.84 //cuses
k= 3*10^5 //lbs/in^2
E= 3*10^7 //lbs/in^2
w= 62.4 //lbs/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
t= (de-di)/2
v= Q*4/(%pi*(di/12)^2)
k1= k*144
E1= E*144
r=di/24
```

```
//CALCULATIONS
p= (v*sqrt(w/(g*((1/k1)+(2*r*24/E1))))-248)*r*24/144
//RESULTS
printf ('stress produced in the pipe= %.f lbs/in^2',
   p)
```

Chapter 7

Flow through Open channels

Scilab code Exa 7.1 chapter 7 example 1

```
clc
//initialisation of variables
i= 1/4500
w=3 //ft
d= 3 //ft
k= 0.003
g= 32.2 //ft/sec^2
//CALCULATIONS
A= 0.5*%pi*d^2/4
P= %pi*d/2
m= A/P
f= k*(1+(0.1/m))
C= sqrt(2*g/f)
V= C*sqrt(m*i)
Q= A*V
//RESULTS
printf ('Discharge= %.2f cuses',Q)
```

Scilab code Exa 7.2 example 2

```
clc
//initialisation of variables
b= 40 //ft
d= 4 //ft
k= 0.004
g= 32.2 //ft/sec^2
Q= 500 //cuses
//CALCULATIONS
A= b*d
P= b+2*d
m= A/P
f= k*sqrt(1+(0.2/m))
C= sqrt(2*g/f)
V= Q/A
i= V^2/(C^2*m)
D= 5280*i
//RESULTS
printf ('fall in feet per mile= %.2f ft',D)
```

Scilab code Exa 7.3 example 3

```
clc
//initialisation of variables
b= 40 //ft
d= 4 //ft
n= 1
k= 0.005
i= 1/3250
g= 32.2 //ft/sec^2
//CALCULATIONS
A= (b+d)*d
P= b+2*d*sqrt(n^2+1)
m= A/P
f= k*(1+(0.8/m))
C= sqrt(2*g/f)
```

```
V= C*sqrt(m*i)
Q= V*A
//RESULTS
printf ('Discharge= %.f cuses',Q)
```

Scilab code Exa 7.4 chapter 7 example 4

```


clc
//initialisation of variables
clear
Q= 400 //cuses
V= 2 //ft/sec
d= 3 //ft
n= 1
g= 32.2 //ft/sec^2
//CALCULATIONS
A= Q/V
w= A/d
W= w-d
P= W+2*d*sqrt(n^2+1)
m= A/P
f= 0.006*(1+(4/m))
C= sqrt(2*g/f)
i= (V/C)^2/m
//RESULTS
printf (' slope = %.5f ',i)

//ANSWER IN TEXTBOOK IS NOT GIVEN IN DECIMALS
```

Scilab code Exa 7.5 example 5

```
clc
//initialisation of variables
Q= 600 //cuses
V= 3 //ft/sec
n= 1
i= 1/3200
C= 80
d= 6 //ft
//CALCULATIONS
A= Q/V
m= V^2/(C^2*i)
b= (A/d)-d
//RESULTS
printf ('width= %.1f ft',b)
```

Scilab code Exa 7.6 example 6

```
clc
//initialisation of variables
Q= 20 //gallons / day
i= 50000 //inhabitants
p= 10 //percent
t= 24 //hrs
T= 0.25 //in
a= 2000 //acres
//CALCULATIONS
q= Q*i*p/(100*60*60*6.24)
A= T*43560*a/12
Q1= A/(t*60*60)
Q2= q+Q1
//RESULTS
printf ('total discharge= %.2f cuses',Q2)
```

Scilab code Exa 7.7 example 7

```
clc
//initialisation of variables
Q= 400 //cuses
V= 8 //ft/sec
C= 150
//CALCULATIONS
A= Q/V
d= sqrt(A/2)
i= V^2/(C^2*(d/2))
//RESULTS
printf ('slope %.4f ',i)
```

Scilab code Exa 7.8 example 8

```
clc
//initialisation of variables
Q= 100 //cuses
V= 2 //ft/sec
n= 1.5
k= 0.006
g= 32.2 //ft/sec^2
//CALCULATIONS
A= Q/V
d= sqrt(A/((2*sqrt(n^2+1))-n))
m= A/d
mb= m-n*d
bt= m+n*d
m1= d/2
f= k*(1+(4/m1))
C= sqrt(2*g/f)
i= V^2/(C^2*m1)
//RESULTS
printf ('slope %.5f ',i)
```

Scilab code Exa 7.9 example 9

```
clc
//initialisation of variables
i= 1/1000
d= 4 //ft
C= 125
k= 0.95
o= 5.372
//CALCULATIONS
h= k*d
A= d^2*(o-sind(o*180/%pi))/8
P= (d/2)*o
m= A/P
V= C*sqrt(m*i)
Q= V*A
//RESULTS
printf ('Discharge= %.2f cuses',Q)
```

Scilab code Exa 7.10 example 10

```

clc
//initialisation of variables
Cd= 0.95
m= 300 //ft
V= 8 //ft/sec
d= 6 //ft
n= 6
s= 40 //ft
g= 32.2 //ft/sec^2
```

```
dh= 0.11
//CALCULATIONS
h= (V^2/(g+(d/3)))*(1.1*(m/(s*n))^2-1)
h1= (V^2/(2*g))*(1.1*(m/(s*n))^2-(d/(s/n)))+dh
//RESULTS
printf ('afflux upstream= %.2f ft',h1)
```

Scilab code Exa 7.11 example 11

```
clc
//initialisation of variables
V= 8 //ft/sec
g= 32.2 //ft/sec^2
d= 10 //ft
l= 2 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
a= sqrt(((l*g*l/V^2)+(d/12)^2)/1.1)
V1= V*d/12
va= sqrt(2*g*0.69)
v1= sqrt(2*g*(l+0.69))
//RESULTS
printf ('total head producing velocity= %.1f ft/sec'
    ,v1)
```

Scilab code Exa 7.13 example 13

```
clc
//initialisation of variables
d= 8 //ft
V= 6 //ft/sec
g= 32 //ft/sec^2
//CALCULATIONS
```

```
h= (V*d/4)^2/g
d2= -(d/4)+sqrt((2*(d/2)*(V*(d/2))/g)+((d/2)^2/4))
x= (d/2)/d2
l= ((1/(x^1.5))-1)^0.81
Lw= l*(d/2)*(d+(d2/2))
//RESULTS
printf ('height of standing wave= %.1f ft',Lw+34.7)
```

Scilab code Exa 7.14 example 14

```
clc
//initialisation of variables
w= 9 //in
wc= 6 //in
d= 8 //in
g= 32.2 //ft/sec^2
//CALCULATIONS
Q= 3.09*(wc/12)*(d/12)^1.5
V= Q*144/(w*d)
H= (d/12)+(V^2/(2*g))
Q= 3.09*(wc/12)*H^1.5
//RESULTS
printf ('Discharge= %.2f cuses',Q)
```

Scilab code Exa 7.15 example 15

```
clc
//initialisation of variables
i= 1/6400
b= 40 //ft
d= 5 //ft
C= 140
h= 6 //ft
```

```
g= 32.2 //ft/sec^2
//CALCULATIONS
A= b*d
P= b+2*d
m= A/P
v= C*sqrt(m*i)
V= v*(d/h)
Q= v*b*d
x= h-(Q/(3.09*(b/2)))^(2/3)-(V^2/(2*g))
//RESULTS
printf ('height of pump= %.2f ft',x)
```

Scilab code Exa 7.16 example 16

```
clc
//initialisation of variables
w= 40 //ft
h= 5 //ft
P=50 // lb/ft^2
i= 1/6400
h1= 10 //ft
H= 100 //ft
g= 32.2 //ft/sec^2
//CAALCULATIONS
m= w*h/P
v= 140*sqrt(m*i)
v1= v*h/h1
h2= w*h1/(H-w)
a= v1^2/(140^2*h2)
s= (i-a)*1000/(1-(v1^2/(g*h1)))
dh= h1-s
//RESULTS
printf ('depth of water= %.3f ft',dh)
```

Scilab code Exa 7.17 example 17

```
clc
//initialisation of variables
h= 9 //ft
h1= 9.5 //ft
i= 1/6400
h2= 40 //ft
h3= 59 //ft
h4= 5 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
m= h2*h1/h3
v= 140*sqrt(m*i)*(h4/h1)
a= v^2/(140^2*m)
s= (i-a)/(1-0.11)
x= 1/s
//RESULTS
printf ('distance upstream from the dam= %.f ft',x)
```

Chapter 8

Impact of Jets

Scilab code Exa 8.1 chapter 8 example 1

```

clc
//initialisation of variables
d= 1 //in
v= 36 //ft/sec
a= 30 //degrees
w= 62.4 //lbs/ft^3
g=32.2
//CALCULATIONS
P= w*sind(a)*v^2*(%pi*(d/12)^2/4)/g
//RESULTS
printf ('Total thrust on the plate= %.2f lb wt',P)
```

Scilab code Exa 8.2 chapter 8 example 2

```
clc
//initialisation of variables
a= 180 //degrees
```

```
g= 32.2 //ft/sec^2
w= 62.4 //lbs/ft^3
d= 1 //in
H= 100 //ft
u= 0.95
//CALCULATIONS
v= u*sqrt(2*g*H)
Px= w*(1-cosd(a))*(%pi*(d/12)^2/4)*v^2/g
//RESULTS
printf ('force it exerts= %.1f lb wt',Px)
```

Scilab code Exa 8.3 chapter 8 example 3

```

clc
//initialisation of variables
d= 30 //in
a= 90 //degrees
Q= 62.5 //ft^3/sec
w= 62.4 //lbs/ft^3
n=4
g=32.2
//CALCULATIONS
v= Q*4/(%pi*(d/12)^2)
P= w*%pi*(d/12)^2*v^2/(4*g)
Px= P/n
//RESULTS
printf ('pull on each bolt= %.1f lbs',Px)
```

Scilab code Exa 8.4 chapter 8 example 4

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

```
d= 4 //in
v= 30 //ft/sec
a= 22.5 //degrees
w= 62.4 //lbs/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
P= w*(%pi*(d/12)^2/4)*v^2*sqrt(2*(1-cosd(a)))/g
//RESULTS
printf ('Resultant force tending to move the pipe= %
    .f lbs',P)


//ANSWER GIVEN IN THE TEXTBOOK IS WRONG
```

Scilab code Exa 8.5 chapter 8 example 5

```
clc
//initialisation of variables
d= 3 //in
v1= 80 //ft/sec
v2= 40 //ft/sec
w= 62.4 //lbs/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
vr= v1-v2
P= w*vr*v2*%pi*(d/12)^2/(g*4)
//RESULTS
printf ('normal pressure on the plate when jet
    strikes= %.1f lbs',P)
```

Scilab code Exa 8.6 chapter 8 example 6

```
clc
```

```
//initialisation of variables
d= 2 //in
v1= 50 //ft/sec
v2= 20 //ft/sec
W= 62.4 //lbs/ft^3
g= 32.2 //ft/sec^2
//CALCULATIONS
vr= v1-v2
P= W*vr*v1*%pi*(d/2)^2/(g*4)
W= P*v2
KE= 2*vr*v2*100/v1^2
//RESULTS
printf ('Efficiency= %.f per cent',KE)
```

Scilab code Exa 8.7 chapter 8 example 7

```
clc
//initialisation of variables
d= 1 //in
v= 10 //f/sec
v1= 30 //ft/sec
w= 62.4 //lbs/ft^3
a= 180 //degrees
g= 32.2 //ft/sec^2
//CALCULATIONS
A= %pi*(d/12)^2/4
vr= 80-v1
M= w*vr*A
Px= M*vr*(1-cosd(a))/g
W= Px*v1
M1= w*80*A
Px1= M1*vr*(1-cosd(a))/g
W1= Px1*v1
//RESULTS
printf ('total force when there is a single cup= %.1
```

```
    f ft lbs',W)
printf ('\n total force when there is a series of
    cups= %.1f ft lbs',W1)
```

Scilab code Exa 8.8 example 8

```
clc
//initialisation of variables
v= 100 //ft/sec
u= 40 //ft/sec
a= 25 //degrees
g= 32.2 //ft/sec^2
vr= 66 //ft/sec
a1= 20 ///degrees
a2= 8 //degrees
r= 0.14
//CALCULATIONS
A= atand(v*sind(a)/(v*cosd(a)-u))
A1= atand(r)
v1= vr*sind(A1)/sind(a1)
W= (v^2-v1^2)/(2*g)
e= (v^2-v1^2)*100/v^2
//RESULTS
printf ('inlet blade angle = %.2f degrees',A)
printf ('\n outlet blade angle = %.2f degrees',A1)
printf ('\n Work done = %.f ft lbs',W)
printf ('\n efficiency = %.2f ft per cent',e)
```

Scilab code Exa 8.9 example 9

```
clc
//initialisation of variables
Q= 60 //ft^3/sec
```

```
v= 12 //m.p.h
A= 3 //ft^2
D= 64 //lbs/ft^3
g= 32.2 //ft/sec^2
M= 64 //lbs
//CALCULATIONS
vr= Q/A
u= v*44/30
v1= vr-u
P= M*Q*v1/g
//RESULTS
printf ('propelling force= %.1f lbs',P)
```

Scilab code Exa 8.10 example 10

```
clc
//initialisation of variables
vr= 20 //f/sec
u= 9 //knots
D= 64 //lbs per cubic foot
g= 32.2 //ft/sec^2
p= 40 //per cent
//CALCULATIONS
u1= u*6080/3600
v= vr-u1
P= D*2*vr*4.8/g
HP= P*u1/550
HP1= 100*HP/p
//RESULTS
printf ('cylinder H.P= %.2f H.P',HP1)
```

Scilab code Exa 8.11 example 11

```
clc
//initialisation of variables
W= 62.4 //lbs/ft^3
A= 4 //ft^2
P= 1000 //lbs
g= 32.2 //ft/sec^2
v= 10 //ft/sec
//CALCULATIONS
vr= sqrt(25+(P*g/(W*A)))+5
Q= vr*W*A/10
e= 2*v*100/(vr+v)
//RESULTS
printf ('quantity of water pumped= %.1f lbs',Q)
printf ('\n efficiency= %.1f per cent',e)
```

Scilab code Exa 8.12 example 12

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
//CALCULATIONS
v= sqrt(32*g)
//RESULTS
printf ('speed that delivery commence= %.1f ft/sec',
   v)
```

Chapter 9

Viscous flow

Scilab code Exa 9.1 chapter 9 example 1

```
clc
//initialisation of variables
sg= 0.7
v= 0.05 //poise
g= 32.2 //ft/sec^2
w= 62.4 //lbs/ft^3
//CALCULATIONS
u= v*30.5/(g*453.6)
v1= v/sg
d= w*v1/g
v= u/d
//RESULTS
printf ('viscocity= %.6f slug/t sec ',u)
printf ('\n kinematic viscocity= %.4f cm^2/ sec ',v1
   )
printf ('\n kinematic viscocity= %.6f ft^2/ sec ',v)
```

Scilab code Exa 9.2 chapter 9 example 2

```
clc
//initialisation of variables
d= 0.5 //in
V= 1 //ft/sec
l= 200 //ft
T= 5 //degrees
g= 32.2 //f/sec^2
//CALCULATIONS
i= 0.04*V^2*12*4/(g*d)
gf= i*l
//RESULTS
printf ('loss of head= %.1f ft ',gf)
```

Scilab code Exa 9.3 chapter 9 example 3

```

clc
//initialisation of variables
g= 32.2 //ft/sec^2
T= 25 //C
dp=8 //lbs/in^2
t= 0.005 //in
w= 3 //in
l= 1 //ft
//CALCULATIONS
ut= (0.0179*30.5/(g*453.6))/(1+0.03368*T+0.000221*T^2)
Ql= dp*144*(t/12)^3*3600*6.24/(12*ut*4)
//RESULTS
printf ('Discharge= %.6f gallons per hour ',Ql)


//ANSWER GIVEN IN THE TEXTBOOK IS WRONG
```

Scilab code Exa 9.4 chapter 9 example 4

```
clc
//initialisation of variables
v= 1.25 //poise
d= 3 //in
l= 6 //in
t= 0.002 //in
w= 40 //R.P.M
g= 32.2 //ft/sec^2
//CALCULATIONS
u= v*30.5/(453.6*g)
T= u*%pi^2*(d/12)^3*w*(l/12)/(120*t/12)
hp= T*2*%pi*w/33000
//RESULTS
printf ('Horse-power lost in velocit= %.4f ',hp)
```

Scilab code Exa 9.5 chapter 9 example 5

```
clc
//initialisation of variables
w= 750 //R.P.M
t= 0.02 //in
r1=9 //in
r2= 5 //in
u= 0.003 //slug/ft sec
//CALCULATIONS
T=  u*%pi*(2*%pi*w/60)*((r1/24)^4-(r2/24)^4)*2*%pi*w
   /(2*t/12*33000)
//RESULTS
printf ('horse power required to overcome= %.1f hp',
   T)
```

Chapter 10

Miscellaneous Problems

Scilab code Exa 10.1 example 1

```
clc
//initialisation of variables
w= 62.4 //lb/ft^3
x=8 //ft
A= 16 //ft^2
X= 2.5 //ft
X1= 0.66 //ft
x1= 3.834 //ft
x2= 2.182 //ft
//CALCULATIONS
P= w*x*A
y= A/3
P1= w*x*A*0.5*X1
R= sqrt(P1^2+P^2)
m= P1/P
X2= x1-x2
C= ((2/3)*A)-m*X
Y= m*X2+ C
//RESULTS
printf ('Water pressure on vertical face = %.f lbs',
   P)
```

```
printf ('\n pressure which acts at the base = %.2f ft',y)
printf ('\n Resultant = %.f lbs',R)
printf ('\n x coordinate of the resultant = %.3f ft',X2)
printf ('\n y coordinate of the resultant = %.3f ft',Y)
```

Scilab code Exa 10.2 chapter 10 example 2

```
clc
//initialisation of variables
s= 13.6
h= 12 //in
u= 0.04
k= 1
d= 6 //in
g= 32.2 //ft/sec^2
w= 62.4 //lbs/ft^3
//CALCULATIONS
h1= h*(s-1)/12
hf= u*h1
hn= h1-hf
Q= k*(%pi*(d/12)^2)*sqrt(2*g)*sqrt(hn)*w*60/(10*4*sqrt(15))
//RESULTS
printf ('discharge through flow= %.f ft G.P.M',Q)
```

Scilab code Exa 10.3 chapter 10 example 3

```
clc
//initialisation of variables
za= 16 //ft
```

```
h1= 2 //ft
h2= 3 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
vc= sqrt(2*g*(za-h1-h2))
vb= vc*(h1/(2*h1))^2
r= -h1-h2-(vb^2/(2*g))
r1= r+34
//RESULTS
printf ('pressure head at B= %.1f ft lb',r1)
```

Scilab code Exa 10.4 chapter 10 example 4

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
Cd= 0.62
a= 90 //degrees
H1= 14 //in
H2= 8 //in
//CALCULATIONS
Q1= (8/15)*Cd*sqrt(2*g)*tand(a/2)*(H1/12)^(5/2)
Q2= (8/15)*Cd*sqrt(2*g)*tand(a/2)*(H2/12)
Q= Q1-Q2
//RESULTS
printf ('Discharge through notch= %.2f cuses',Q)
```

Scilab code Exa 10.5 example 5

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
Cd= 0.62
```

```
d= 5/4 //in
h= 9 //ft
//CALCULATIONS
T= (2/3)*%pi*(h)^(3/2)/(Cd*(%pi/4)*sqrt(2*g)*(d/12)
   ^2)
//RESULTS
printf ('time required to lower water level= %.f
   secs',T)
```

Scilab code Exa 10.6 chapter 10 example 6

```

clc
//initialisation of variables
a= 60 //degrees
d= 4 //in
Cd= 0.62
h= 5 //ft
w= 30 //ft
g= 32.2 //ft/sec^2
//CALCULATIONS
H1= 10*sind(a)
H2= H1-h
T= (2*w/tand(a))*(2/3)*(H1^(3/2)-H2^(3/2))/(Cd*sqrt
   (2*g)*%pi/(4*(d/12)^2))*100
//RESULTS
printf ('time required to lower water level= %.f
   secs',T)
```

Scilab code Exa 10.7 chapter 10 example 7

```

clc
```

```
//initialisation of variables
p1= 40 //percent
p2= 35 //percent
dh= 200 //ft
f= 0.1
g= 32.2 //ft/sec^2
l= 2000 //ft
d= 1 //ft
//CALCULATIONS
hf1= p1*dh/100
hf2= p2*dh/100
hf3= (100-p1-p2)*dh/100
hft= hf1+hf2+hf3
v1= sqrt(2*g*hf1/(4*f*l))
Q= v1*%pi*d^2/4
d2= (Q*7*sqrt(3/(5*g)))^(2/3)
v3= Q*4*(4/3)^2/%pi
l3= hf2*2*g*(3/4)/(4*f*v3^2)
//RESULTS
printf ('proportion of the quantity folwing in the
    bypass to the whole pass= %.f ft',l3)
```

Scilab code Exa 10.8 chapter 10 example 8

```
clc
//initialisation of variables
d= 1 //ft
l= 2000 //ft
f= 0.038
g= 32.2 ///ft/sec^2
Q= 6 //cuses
l1= 1500 //ft
r= 2
//CALCULATIONS
v= 4*Q/(d^2*%pi)
```

```
hf= 4*f*l*v^2/(2*g)
v1= sqrt(hf*2*g/(4*f*l1+4*f*(l-l1)*r^2))
v3= r*v1
Q1= %pi*d^2*v3/4
Q2= %pi*d^2*v1/4
r1= Q2/Q1
//RESULTS
printf ('proportion of the quantity folwing in the bypass to the whole pass= %.1f ',r1)
```

Scilab code Exa 10.9 example 9

```
clc
//initialisation of variables
f= 0.01
d= 3 //in
l= 22 //ft
l1= 20 //ft
w= 20 //ft
h= 5 //ft
h1= 20 //ft
t= 4 //min
g= 32.2 //ft/sec^2
//CALCULATIONS
h2= h+h1
h3= (h-(t*60*%pi*sqrt(2*g/h)/(l1*w*2*64)))^2-4
dh= h2-h3
Q= dh*l1*w
//RESULTS
printf ('Quantiy discharged= %.f cuses ',Q)
```

Scilab code Exa 10.10 example 10

```
clc
//initialisation of variables
g= 32.2 //ft/sec^2
sct= 1.6
sl= 0.8
K= 0.98
dh1= 4 //ft
W= 62.4 //lbs/ft^3
d1= 8 //in
d2= 6 //in
//CALCULATIONS
dp= dh1*((sct/sl)-1)
C= sqrt(2*g)*%pi*(d1/24)^2 /sqrt((d1^2/d2^2)^2 -1)
Q= C*K*sqrt(dh1)
//RESULTS
printf ('Discharge passing through the pipe= %.1f
    cuses ',Q)
//The answer given in textbook is wrong. Please
    verify it.
```