Scilab Textbook Companion for Water and Wastewater Engineering by G. M. Fair, J. C. Geyer and D. A. Okun[1]

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Book Description

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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 2

Water system

Scilab code Exa 2.1 Example 1

```
clc
//initialisation of variables
w=3000//sq ft
w1=2000//sq ft
w2=1000//sq ft
r=15//in
a=12//in
h=7.5//in
//CALCULATIONS
G=w*(r/a)*h//gal
g=w1*(r/a)*h//gal
g1=w2*(r/a)*h//gal
//RESULTS
printf('the normally be stored to tide the supply
   over dry spells=% f gal',G)
```

Scilab code Exa 2.2 Example 2

```
clc
//initialisation of variables
m=17.378//mg
h=20//in/sq mile
d=365//in
s=0.75//percent
a=100//sq miles
p=750000//gpd per sq mile
t=180//in
c=150//gpcd
n=64699 //gpd per sq mile
//CALCULATIONS
R=h*m//mg
A=R/d//mgd
S=s*a*t//billion gal
Q=a*p/c//gpd
P=a*n/c//people against
//RESULTS
printf('the surface water sheds and storage
   requirements=% f mg',R)
printf('the well watered sections of north america=%
    f billion gal',S)
printf('the average consumpition populations=% f gpd
   ',Q)
printf('the presence of proper storage=% f people
   against',P)
```

Scilab code Exa 2.3 Example 3

```
clc
//initialisation of variables
w=20//ft
r=3//ft a day
g=500//ft
g1=1000//ft
```

```
h=7.5/1440//ft
p=7.5/1000000//ft
r1=2//ft a day
//CALCULATIONS
W1=w*g1*r*h//gpm
W2=w*g1*r1*r*p//mgd
//RESULTS
printf('the ground water laterally =% f gpm',W1)
printf('the water from both sides=% f mgd',W2)
```

Scilab code Exa 2.4 Example 4

```
clc
//initialisation of variables
p1=10//mgd
p2=6940//gpm
w=67000//people
d=2//min
v=d*p2/d//gal
v1=98.2//cu ft each
q=30//min
q1=q*p2/d//gal
q2=13900//cu ft
a=1390//sq ft
s=2//hr
s1=120*p2/d//gal
s2=55700//cu ft
s3=s2/8//sq ft
r=3//gpm/sq ft
r1=6//rapid
//CALCULATIONS
D=sqrt(v1*4/%pi)//ft
S=p2/s3//gpm/sq ft
A=p2/(r1*r)//sq ft
//RESULTS
```

```
printf('the capacity of the components of a rapid
   sand filtration plant=% f sq ft',A)
```

Scilab code Exa 2.5 Example 5

```
clc
//initialisation of variables
r=10000//ft
l=400000//people
q=1000000//mgd
w=100//gpcd
w1=150//gpcd
m=50//percent
g=1.5//ft
h1=2.32//cfs
h2=139//cfs
d=12//ft
c=100//ft
l=10.8//ft
l2=0.85//ft
l1=1000//ft
//CALCULATIONS
a=r*w/q//mgd
b=l*w1/q//mgd
a1=a*g//mgd
b1=b*g//mgd
D=d*sqrt(h1/%pi)//in
D1=d*sqrt(h2/%pi)//in
L=l/l1//ft
L1=l2/l1//ft
//RESULTS
printf('the higher loss of head in small conduits at
    equal velocity=% f ft',L1)
```

Scilab code Exa 2.6 Example 6

```
clc
//initialisation of variables
a=12//in
b=24//in
r=500//gpm
d=200//gpcd
d1=150//gpcd
p1=113//sq in
p2=425//sq in
v1=3//fps
v2=2.35//cfs
v3=9.42//cfs
h=646000//gpd
w=720000//gpd
//CALCULATIONS
D1=v2*h//gpd
D2=v3*h//gpd
W1=D1-w//gpd
W2=D2-w//gpd
R1=D1/d//people
R2=D2/d//people
S=W1/d1//people
S1=W2/d1//people
//RESULTS
printf('the absence of fire service for a maximum
   draft=% f gpd',D2)
printf('The residential fire flow requirements=% f
   gpd',W2)
```

Scilab code Exa 2.7 Example 7

```
clc
//initialisation of variables
w=100000//ft
c=250//per capita
p1=0.3//percent
p2=0.1//percent
p3=0.60//percent
w1=15//mgd
//CALCULATIONS
T=c*w//$
W=p1*T//$
W1=p2*T//$
W2=p3*T//$
W3=((w1)^2/3)*T//$
//RESULTS
printf('the replacement cost of the water of a city=
   %f $',W3)
```

Chapter 3

Wastewater systems

Scilab code Exa 3.1 Example 1

```
clc
//initialisation of variables
v=2.5//fps
c=0.013//gpd
p=300//gpd
d=50//per care
m=5.20//ft
a=1000//ft
//CALCULATIONS
C=[(%pi*64)/(4*144)]*v*646000//gpd
M=m/a//ft
P=C/p
A=P/d//acres
//RESULTS
printf('the acres will it drain if the population
   density=% f acres',A)
```

Scilab code Exa 3.2 Example 2

```
clc
//initialisation of variables
a=37.4//acres
r=2//in
p=30//min
v=3//fps
r1=0.6//in
h=1.0//cfs
p1=50//percent
q=646000//gpd
//CALCULATIONS
R=r*r1*a//cfs
A=R/v//sq ft
D=12*sqrt(4*A/%pi)//in
P=r*r1*q/p1//gpcd
//RESULTS
printf('the per capita storm runoff for a population
    density=% f gpcd',P)
```

Scilab code Exa 3.3 Example 3

```
clc
//initialisation of variables
w=1.0//cfs
w1=3.0//cfs
w2=45.0//cfs
v=3.0//fps
h=144//ft
D=12*sqrt(4*w/(%pi*w1))//in
d1=1.95//cfs
D1=12*sqrt(4*d1)/(%pi*v)//in
d2=41.6//cfs
D2=12*sqrt(4*d2)/(%pi*w1)//ins
//CALCULATIONS
C=%pi*(D)^2*3/(4*h)//cfs
```

```
C1=%pi*(1/4)*3//cfs
V=(d2*4)/(%pi*4^2)//fps
//RESULTS
printf('The minimum dry-weather flow =% f cfs',C)
printf('The maximum dry-weather flow in excess
    actual capacity=% f cfs',C1)
printf('the storm flow in axcess of maximum dry-
    weather flow=% f fps',V)
```

Scilab code Exa 3.4 Example 4

```
clc
//initialisation of variables
t=0.8//mgd
d=8000//people
a=2//hr
v=800000//ft
h=10//ft
a1=4//in
d1=1//sq ft per capita
a3=3//mgad
//CALCULATIONS
V=v*(a/24)/a//gal
S=V/h//sq ft
S1=(v/h)/S//gpd per sq ft
V1=a*d/h//cu ft
D=d/S//ft
E=d1*d/a1//sq ft
A=t/a3//acre
//RESULTS
printf('the capacity of the components of a small
    trickling-filter =% f acre',A)
```

Scilab code Exa 3.5 Example 5

```
clc
//initialisation of variables
w=2000//sq miles
r=0.1//cfs
d=80000//ft
p=100//gpd
p1=80//ft
p2=340//percent
h=646000//ft
//CALCULATIONS
L=r*w//cfs
R=6*p1/1.4//cfs
P=p1*(p2-L)/p2//percent
D=(d*p)//gpd
D1=(L*h)//gpd
//RESULTS
printf('the percent of removal of pollutional load
   needed=%f percent',P)
```

Scilab code Exa 3.6 Example 6

```
clc
//initialisation of variables
p=10000//people
p1=4//ft
w=10//in
s=80//gpcd
h=43560//ft
p2=20//ft
//CALCULATIONS
R=[(w/12)*7.5*h]/365//gpad
A=p*s/R//acres
A1=1.7//sq miles
```

```
P=p/500//acres
D=p2*h*4*7.48/(p*s)//days
//RESULTS
printf('the detention period in ponds =% f days',D)
```

Scilab code Exa 3.7 Example 7

```
clc
//initialisation of variables
p=100000//people
a=75//$
a2=47//in
b=10//in
//CALCULATIONS
P=a*p//people
S=((a)*(b^5))/(b)^1/4//$
//RESULTS
printf('the money is inversed in the sanitary
    sewerage system=% f $',S)
```

Chapter 4

Information analysis

Scilab code Exa 4.1 Example 1

```
clc
//initialisation of variables
y=19.5//in
x=396.8//in
n=6//in
y1=2.20//in
x1=51.14//in
p=5.64//in
//CALCULATIONS
Beta=(x-n*(y)*(y1))/(x1-n*(y1)^2)
X=p+Beta//minimum
//RESULTS
printf('the method of leate squares =% f minimum',X)
```

Scilab code Exa 4.3 Example 2

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

```
a=12//in
h=121//in
p=11//in
s=220//in
//CALCULATIONS
B={a/[p*(h-1)]}*s//per unit
//RESULTS
printf('the interval of time a noted before=%f per
    unit',B)
```

Scilab code Exa 4.5 Example 3

```
clc
//initialisation of variables
a=4404//ft
q=9//ft
mu=12//ft
//CALCULATIONS
F=sqrt(a/q)//ft
CF=F/mu*100//percent
//RESULTS
printf('the coefficient of fluctuation is =%f
    percent',CF)
```

Scilab code Exa 4.7 Example 4

```
clc
//initialisation of variables
h2=5//in
x=3.72//in
x1=1.28//in
//CALCULATIONS
H=h2*x1/x//in
```

```
//RESULTS
printf('the either side of the center of the scale=%f in',H)
```

Scilab code Exa 4.8 Example 5

```
clc
//initialisation of variables
p=80//in
q=20//in
//CALCULATIONS
K=p+q//ft
//RESULTS
printf('the moments of the arithmetically normal frequency curve=%f ft',K)
```

Scilab code Exa 4.9 Example 6

```
clc
//initialisation of variables
g=3.2541//in
g1=3.46//in
m=0.5390//ft
h=2/99//ft
p=1.52//ft
//CALCULATIONS
L=sqrt(g*h)//in
mu=g1*p//in
M=g1/p//percent
//RESULTS
printf('the points necessary to plot the straigt line of fit on log probability=%f percent',M)
```

Chapter 5

Water and wastewater volume

Scilab code Exa 5.1 Example 1

```
clc
//initialisation of variables
t1=5.25//yr
t2=10.00//yr
yi=171000//in
ye=111000//in
yt=5.23300//in
yl=5.04532//in
yn=31500//in
ym=0.09853//in
tm=9.25//yr
tn=10.00//yr
//CALCULATIONS
T=t1/t2//yr
T1=tm/tn//yr
Y=yi-ye//in
Yt=yt-yl//in
//RESULTS
printf('the fifth intercensal year =% f yr',T)
printf('the ninth postcensal year =% f yr',T1)
```

Scilab code Exa 5.2 `Example 2`

```
clc
//initialisation of variables
y0=30000//in
y1=172000//in
y2=292000//in
a=172//ft
p=30//ft
y=292//ft
q=322000//ft
g=313//ft
n=0.05//ft
d=-2.442//ft
//CALCULATIONS
L=[2*p*a*y2-(a)^2*q]/[p*y-(a)^2]//moreover
m=(g-p)/p//ft
N=n*d//in
Y=g/[1+m*(N)]//in
//RESULTS
printf('the saturation populations=% f moreover',L)
printf('the coefficients=% f in',N)
printf('the equation of a logistic curve=% f in',Y)
```

Scilab code Exa 5.4 `Example 3`

```
clc
//initialisation of variables
p=100000//in
d=150//in
h=1000000//in
a1=2.0//draft
```

```
a2=3.0//draft
a3=1.6//draft
m=1.5//in
q=2.5//in
v=1020//in
w=100//in
t=0.01//in
v1=13.2//mgd
//CALCULATIONS
A=d*p/h//mgd
M=m*A//mgd
M1=q*A//mgd
V=v*sqrt(w)*(1-t*sqrt(w))//gpm
D=M+v1//mgd
L=a1*A//mgd
L1=(4/3)*M//max
H=a2*A//mgd
H1=(4/3)*M1//max
F=a3*A//mgd
F1=(4/3)*M//max
//RESULTS
printf('the resulting capacities of the four system
    =% f max',F1)
```

Scilab code Exa 5.6 Example 4

```
clc
//initialisation of variables
r=48//in
A=450//gpd/acre
B=8000//gpd/mile
S=5280/350//manholes/mile
//CALCULATIONS
C=(B-S*100)/12//gpd/mile
//RESULTS
```

```
printf('the ground a quarter of it eventually =%f
    gpd/mile',C)
```

Scilab code Exa 5.7 Example 5

```
clc
//initialisation of variables
p1=20//ft
p2=30//ft
w=5//person
s=17800//in
h=1200//in
q=100//in
i=1//in
//CALCULATIONS
S=p1*p2*i*s/(h*w)//gpcd
P=(q*p1*p2/S)//percent
//RESULTS
printf('the degree of separation of stormwater=%f
    percent',P)
```

Scilab code Exa 5.8 Example 6

```
clc
//initialisation of variables
s=105//gpcd
m=315//gpcd
m1=35//gpcd
Q1=360//gpcd
Q2=30//gpcd
p1=20//pecent
p2=15//persons/acer
D=21//persons/acre
```

```
I=2000//gpd/acre
//CALCULATIONS
A=D*(s+Q2)+I//gpd/acre
R=D*(m+Q2)+I//gpd/acre
L=D*(m1+Q2)+I//gpd/acre
//RESULTS
printf('the average peak and low rates of flow =% f
    gpd/acre',L)
```

Chapter 6

Elements of hydrology

Scilab code Exa 6.1 Example 1

```
clc
//initialisation of variables
H=1360//ft
t=60//f
a=(10^3)*5.5*(10^-3)//f
q=(1.36*10^3)*5.5*(10^-3)//f
s=(4-1.36)*(10^3)*(3.2*10^-3)//f
//CALCULATIONS
T=t-q-s//F
T1=T+3*a//F
//RESULTS
printf('the temperature at the mountain top=% f F',T
   )
printf('the temperature on the plain beyond the
   mountain=% f F',T1)
```

Scilab code Exa 6.2 Example 2

```
clc
//initialisation of variables
t=60//f
v=0.52//in
t1=80//F
p=40//percent
v1=1.03*0.40//in
w=8//mph
pa=29.0//in
p1=0.497//ft
q=1.32*10^-2//ft
r=0.268//ft
//CALCULATIONS
E=p1*(1-q*pa)*(1+r*w)*(v-v1)//in
//RESULTS
printf('the evaporation for the a day during=% f in'
    ,E)
```

Scilab code Exa 6.3 Example 3

```
clc
//initialisation of variables
t=47//f
q=8000//ft
a=100//ft
d=0.10//in
d1=7//degree days
s1=14000//ft
s2=7000//ft
s=1000//ft
g=32//ft
h=17.37//ft
h1=1.547//ft
//CALCULATIONS
T=q+s*(t-g)/3//ft
```

```
T1=t-3*1//F
T2=(T1+g)/2//F
T3=d1*d*a//sq mile in
M=h*T3//mgd
M1=M*h1//cfs
//RESULTS
printf('the upper boundary of the melting zone and
    temperature at the snow line=% f F',T1)
printf('The average temperature of =% f cfs',M1)
```

Chapter 7

Rainfall and runoff

Scilab code Exa 7.5 `Example 1`

```
clc
//initialisation of variables
n=20//ft
s=sqrt(12676/19)//ft
c=45.5//ft
q=551400//ft
q1=12700//ft
h=8.5//ft
w=s/c//ft
//CALCULATIONS
D=q/(2*s*q1)//cfs
D1=D*(1+h/n)//cfs
//RESULTS
printf('the record runoff of a stream draining=% f
    cfs',D1)
```

Scilab code Exa 7.6 `Example 2`

```
clc
//initialisation of variables
i=16/(62)^0.66//in hr
q=(16*10^0.31)/(62)^0.66//in hr
c=1.0//max
C1=c*(0.01)^0.31//in
C2=c*(0.1)^0.31//in
x1=640//cfs
//CALCULATIONS
Y1=C1*i*c*x1//cfs
Y2=C2*q*c*x1//cfs
//RESULTS
printf('the time of concentration=% f cfs',Y2)
```

Scilab code Exa 7.8 Example 3

```
clc
//initialisation of variables
d=163*48.5//cfs
a=48.5//ft
q=100//cfs
Q=45.5*a//cfs
c=0.57//cfs
v=1.8//cfs
p=0.45//ft
//CALCULATIONS
P=d/(q*sqrt(a))//percent
C=Q/(a^0.8*(1+2*a^-0.3))//cfs
d1=2.6//cfs
T=(1-p*c+v*c*2)//cfs
//RESULTS
printf('the meyers rating =% f percent',P)
printf('the magnitude of the maximum peak flood =% f
    cfs',T)
```

Chapter 8

Storage and runoff control

Scilab code Exa 8.2 Example 1

```
clc
//initialisation of variables
a=0.75//ft
p=123//mg
v=100//ft
s=33//mg
s1=67//mg
d=26.6//mgd
d1=0.0477//mgd
q=0.750//gpd/sq mile
d2=365//days
//CALCULATIONS
S=p/a//mg per sq mile
Cv=v*s/s1//percent
M=d*d1//mgd per sq mile
D=v*q/M//MAF
D1=(v*p)/(M*d2)//MAF
R=p/q//days
//RESULTS
printf('the use monthly averages rather then daily
   stream flow=% f days',R)
```

Scilab code Exa 8.3 Example 2

```
clc
//initialisation of variables
d=750000//gpd per sq mile
v=0.22//ft
a=1.27//ft
q=0.30//ft
d1=365//days
p=0.25//ft
//CALCULATIONS
Q=q*a*d1//mg/sq mile
H=p*a*d1//mg/sq mile
//RESULTS
printf('the results obtained by normal analytical
   procedures and by Hazen s=% f mg/sq mile',H)
```

Scilab code Exa 8.4 Example 3

```
clc
//initialisation of variables
d=30.0//mgd
a=40.0//sq miles
a1=1500//acres
r1=47.0//in
r2=27.0//in
q=0.9//in
k=640//in
h=0.052//gpd/sq mile
//CALCULATIONS
Q=r2-(r2+a-r1)*q*a1/(k*a)//in
```

```
D=d+a*h//mgd
A=a-(q*a1/k)*[1-(r1-a)/(r2)]//sq miles
R=r2+a-r1//in
S=R*q//in
//RESULTS
printf('the revised mean annual runoff=%f in',Q)
printf('the equivalent mean draft=%f mgd',D)
printf('the equivalent land area=%f sq miles',A)
printf('the adjusted flowline=%f in',S)
```

Scilab code Exa 8.6 Example 4

```
clc
//initialisation of variables
p=100//ft
q=27000//acre-ft
p1=10//ft
s=8250//acre-ft
//CALCULATIONS
R=p*s/q//percent
//RESULTS
printf('the ratio of peak inflow from fuller values=
    %f percent',R)
```

Chapter 9

Groundwater flow

Scilab code Exa 9.1 Example 1

```
clc
//initialisation of variables
t=10//C
s=74.2//days
c=0.01//mm
d=245//mm
//CALCULATIONS
h=s/(d*c)//cm
//RESULTS
printf('the high will water at a temperature =% f cm
    ',h)
```

Scilab code Exa 9.2 Example 2

```
clc
//initialisation of variables
p1=1000//ft
p2=50//ft
```

```
g=20//ft/mile
v=5280//ft
q=7.5*10^-6//ft
t=60//F
k=2835//ft/days
p=7.5//ft
//CALCULATIONS
S=g/v//ft
W=k*(g/v)//ft/day
Q=W*p1*p2*q//mgd
P=k*p//ft
P1=P*p2//mgd
//RESULTS
printf('the velocity of flow =% f mgd',Q)
printf('the standard coefficient pf permeability=% f
   mgd',P1)
```

Scilab code Exa 9.3 Example 3

```
clc
//initialisation of variables
p=40//ft
d=56//ft
d1=140//ft
p1=30//ft
w=3.28*10^-4//fps
//CALCULATIONS
Q=w*(p/d1)*2*d*p//cfs
q=Q/p//cfs
K=w*(p/d1)//fps
x0=q/(2*%pi*K)//ft
Z=2*%pi*x0//ft
//RESULTS
printf('the yield of the well if the coefficient of
   permeability=% f ft',x0)
```

```
printf('the distance of the point of stagnation =% f
    ft',Z)
```

Scilab code Exa 9.4 Example 4

```
clc
//initialisation of variables
p=5*10^6//ft
Q=350//gpm
x=225//ft
u=10^-2//ft
g=1.87//ft
p2=7*10^2//ft
p3=10.9//ft
w=4.0//ft
t=114.6//ft
d=10//ft
p1=5//ft
w1=3.2*10^4//ft
W=21.75//ft
//CALCULATIONS
T=t*Q*4/p1//gpd/ft
S=u*(w1)/[g*(p)]//ft
U=g*[(S)/(T)]*(x^2/d)//ft
P=t*(p2)*p3/(T)//ft
U1=g*[(S)/(T)]*(1/d)//ft
P1=t*(p2)*W/(T)//ft
//RESULTS
printf('the type curve as if a transparency of the
   observed data had moved into place over the type=
   % f ft',P1)
```

Scilab code Exa 9.5 Example 5

```
clc
//initialisation of variables
Q=350//gpm
x=225//ft
t=1//min
p=1.6//ft
t2=10//min
p2=4.5//ft
p3=700//gpm
T=3.2*10^4//gpd/ft
t0=0.3//min
u=1.15*10^-5
//CALCULATIONS
S=t0*(T)*t0/[(x)^2*1440]//ft
P=[(114.6*p3)/(T)]*(-0.5772*2.3*log(u))//ft
//RESULTS
printf('A straight line being drawn through the
   ppints for the higher=% f ft',P)
```

Scilab code Exa 9.6 Example 6

```
clc
//initialisation of variables
h=4.8//ft
m=13.4//ft
k=10^-1//cm/sec
k1=3.28*10^-3//fps
n=7//ft
n1=11//ft
q=1.0*10^-2
//CALCULATIONS
Q=k1*h*n/n1//cfs/ft
Q1=2*q*10^2//cfs
//RESULTS
printf('A satisfactory orthogonal system the flow of
```

```
into the collector =% f cfs',Q1)
```

Chapter 10

Groundwater collection

Scilab code Exa 10.1 Example 1

```
clc
//initialisation of variables
w1=1000//ft
w2=2000//ft
r=700//gpm
d=10//days
q=2//ft
u=1.87*[(3.4*10^-5)/(3.2*10^4)]*(d^6/d)//ft
W=7.94//ft
p=114.6*(7*10^2)*W/(3.2*10^4)//ft
U=1.87*[(3.4*10^-5)/(3.2*10^4)]*(4*d^6/d)//ft
Wu=6.55//ft
P=114.6*(7*10^2)*Wu/(3.2*10^4)//ft
R=54//ft
//CALCULATIONS
W1=R+p+P//ft
D=R+q*p//ft
//RESULTS
printf('the expected drawndown the first well is pumped at a rate=%f ft',W1)
printf('the drawdown in each well all the three are
```

```
pupped at a rate=% f ft',D)
```

Scilab code Exa 10.3 Example 2

```
clc
//initialisation of variables
g=20//ft
k=10^-1//cm/sec
g1=3.28*10^-3//fps
w=2//ft
w1=30//ft
//CALCULATIONS
Q=(1/2)*(g1)*[(g^2)-(2^2)]/(w1)//cfs
//RESULTS
printf('the flow into a foot of gallery=% f cfs',Q)
```

Chapter 11

Surface water collections

Scilab code Exa 11.1 Example 1

```
clc
//initialisation of variables
s=20//mph
t=90//min
w=1.31//ft
h=7.5//miles
h1=0.22//ft
t1=1100//min
t2=6.0//min
p=32.2//ft
l=5.12//length
l1=2.8//length
p1=1400//ft
d=73//depth
h3=2.06//ft
e=173.0//ft
hi=0.2//ft
//CALCULATIONS
W=s*w//mph
hs=h1*[(W)^2/p]^0.53*h^0.47//ft
Ts=t2*(W/p)^0.44*(h/p)^0.28//sec
```

```
Td=t1*h/(p*Ts)//min
Ls=l1/(l*(Ts)^2)//ft
D=d/(l*(Ts)^2)//ft
H=(W)^2*[h*(1/(p1*d))]//ft
hr=h3*l1//ft
M=e+hi+hr//ft
//RESULTS
printf('the overwater wind speed=% f mph',W)
printf('the significant wave height=% f ft',hs)
printf('the significant wave period=% f sec',Ts)
printf('the minimum wind duration required to reach
   the significant wave height=% f min',Td)
printf('the significant wave lenght adn steepness=%
   f ft',Ls)
printf('the reservoir depth ratio=% f ft',D)
printf('the wind tide or set up=% f ft',H)
printf('the run up =% f ft',hr)
printf('the maximum elevation reached by the waves=%
    f ft',M)
```

Scilab code Exa 11.2 Example 2

```
clc
//initialisation of variables
g=264//quartz
p=0.39//percent
//CALCULATIONS
S=(1-p)*(g-1)//in
//RESULTS
printf('the hydralic gradient and seepage velocity=%
    f in',S)
```

Scilab code Exa 11.3 Example 3

```
clc
//initialisation of variables
w=40//ft
k=2*10^-3//cm/sec
p=3.28*10^-3//cfs
h=6.47*10^5//gpd
p1=0.433//ft
m=9//ft
delh=w/(18*9)//in
k1=4.94*10^-4//cm/sec
//CALCULATIONS
Q=k*p*w*(9/18)//cfs
Q1=Q*h//gpd/ft width
P=(1-8/18)*w*p1//Psig
H=k1/k//in
//RESULTS
printf('the seepage through each foot width of the
    foundation=%f gpd/ft/ width',Q1)
printf('the excess hydrostatic pressure on the
    upstream side of the bottom of the sheet pilling
    =%f Psig',P)
printf('the maximum hydraulic gradient and its
    relations to the coeeficent=%f in',H)
```

Scilab code Exa 11.4 Example 4

```
clc
//initialisation of variables
d=120//ft
w=16//ft
d1=120/0.8//ft
p=60*0.8//ft
h=2//ft
v=18.74*0.8//ft
s=95.23//ft
```

```
s1=0.8//ft
//CALCULATIONS
W=d-h*p//ft
S=s*s1//ft
//RESULTS
printf('in succession from the intersection of the
    upstream slop=% f ft',S)
```

Chapter 12

Water transmission

Scilab code Exa 12.1 Example 1

```
clc
//initialisation of variables
c=100//in
a=10//in
Q=0.976//ft
//CALCULATIONS
G=a*Q//ft
//RESULTS
printf('the graphical basic =%f ft',G)
```

Scilab code Exa 12.2 Example 2

```
clc
//initialisation of variables
a=27.6//sq ft
h=1.37//ft
d=1.53*(27.9)^0.38*(1.36)^0.24//ft
//CALCULATIONS
```

```
R=d/4//ft
A=(%pi*d^2)/4//sq ft
//RESULTS
printf('The diameter hydraulics radius and area of
    the hydraulically equivalent circular conduit=% f
    sq ft',A)
```

Scilab code Exa 12.3 Example 3

```
clc
//initialisation of variables
h1=13.5//ft
h2=19.0//ft
h3=27.5//ft
c1=2.0*10^4//ft
c2=2.1*10^4//ft
c3=2.2*10^4//ft
//CALCULATIONS
H=h1+h2+h3//ft
C=c1+c2+c3//ft
//RESULTS
printf('the most economical distributions of the
    available head=% f ft',C)
```

Scilab code Exa 12.4 Example 4

```
clc
//initialisation of variables
p=60//in
h=20//percent
a=1000//ft
h1=40//percent
c=0.5//ft
```

```
p1=14.3//ft
p2=6.1//ft
d=11.7*10^-2//ft
//CALCULATIONS
P=p2/p1//ft
D=d*p//ft
//RESULTS
printf('the air valve with a discharge the change in
    slop=% f ft',D)
```

Scilab code Exa 12.5 Example 5

```
clc
//initialisation of variables
p=90//deg
h=48//in
p1=100//psig
P=(1/2*%pi)*h^2*p1*0.7071//lb
r=3000/54-31//ft
s=9000//psi
l=170//in
b=6.5*10^-6//ft
w=46//ft
w1=1000//ft
//CALCULATIONS
D=(1/4*%pi)*h^2*p1//lb
P=[r]*h^2//lb
T=%pi*h*(1/4)*s//lb
T1=(1/2)*l//tons
Del=b*w*w1//ft per
//RESULTS
printf('the accorance with unless otherwise stated=%
    f ft per',Del)
```

Chapter 13

Water distribution

Scilab code Exa 13.2 Example 1

```
clc
//initialisation of variables
p1=7.8//ft
p2=6.0//ft
p3=7.4//ft
p4=6.5//ft
p=7.6//ft
h=1.0//ft
h1=6.7//ft
p5=3.3//ft
//CALCULATIONS
D=p1-p2//mgd
D1=p1-p3//mgd
D2=p-p4//mgd
D3=p4+h//mgd
D4=h1-p5//mgd
//RESULTS
printf('the demand is taken =% f mgd',D3)
```

Scilab code Exa 13.3 Example 2

```
clc
//initialisation of variables
w=500//ft
p=20//psig
h=40//psig
h1=1000//in
q=1250//ft
g=2.308/0.75//ft
g1=2.308/1.00//ft
s=5200//gpm
a=250//gpm
//CALCULATIONS
H=[h1-(1/2)*(w)]//ft
H1=(h-p)*g//percent
Q=[q-(1/2)*(w)]//ft
Q1=(h-p)*g1//percent
S=s/a//gpm
//RESULTS
printf('the number of standard fire streams=%f gpm'
    ,S)
```

Scilab code Exa 13.6 Example 3

```
clc
//initialisation of variables
h1=2.1*3//ft
h2=2.1//ft
h=8.4//ft
p=1000//ft
h3=5.7//ft
h4=4.2*3//ft
q=4.2//ft
s=1.68//ft
```

```
q1=1.33//ft
//CALCULATIONS
A=p*h/h2//ft
B=p*(h3+h4)/q//ft
C=p*(h1+h2)/s//ft
//RESULTS
printf('the equilent pipe for the Hazen willians
    coefficent=% f ft',A)
printf('the equilent pipe for the Hazen willians
    coefficent=% f ft',B)
printf('the equilent pipe for the Hazen willians
    coefficent=% f ft',C)
```

Scilab code Exa 13.8 Example 4

```
clc
//initialisation of variables
d=10//hr
p=50000//in
a=7.5//mgd
w=0.75//mg
s=5.03//mg
//CALCULATIONS
S=s/w//mg
P=S-s//mg
//RESULTS
printf('a steady gravity supply equal to maximum
    daily=% f mg',P)
```

Chapter 14

Wastewater flows

Scilab code Exa 14.1 `Example 1`

```
clc
//initialisation of variables
n=0.013//ft
s=4.90//ft
v=0.590//ft
d=0.463//ft
w=3.9*10^-2//ft
p=1.696//ft
//CALCULATIONS
V=s*v//fps
Q=s*d//cfs
N=(w*p)^2*1000//percent
//RESULTS
printf('the velocity of flow and rate of discharge=%
    f percent',N)
```

Scilab code Exa 14.2 `Example 2`

```
clc
//initialisation of variables
v=1.34//fps
s=3.7*10^-3//fps
k=0.8//ft
r=20//ft
k1=0.04//ft
v=3.0//fps
v1=5.0//fps
d=10^-1//ft
d1=1.34//ft
//CALCULATIONS
K=r*k1//ft
V=sqrt(r)//times
D=d*(v/d1)^2//cm
D1=d*(v1/d1)^2//cm
//RESULTS
printf('the minimum velocity and the gradient at the
    which coarse quartz=% f cm',D1)
```

Scilab code Exa 14.3 Example 3

```


clc
//initialisation of variables
v=2.5//fps
q=0.873//cfs
s=5.20//percent
a=0.252//ft
r=0.684//ft
r1=1.46//ft
v1=0.776//ft
q1=0.196//ft
n=0.78//ft
```

```
R=0.939//ft
//CALCULATIONS
V=v1*v//fps
Q=q1*q//cfs
R1=r1*s//percent
Vs=R*v//ft
N=n*Vs//fps
Qs=a*R*q//cfs
N1=n*Qs//cfs
//RESULTS
printf('the required grades and associated velocity
    and rates=% f cfs',V)
printf('the depth and a grade=% f cfs',Q)
printf('the self cleaning flow=% f cfs',N1)
```

Scilab code Exa 14.4 Example 4

```
clc
//initialisation of variables
Q=0.873//cfs
s=5.20//percent
d=0.161//cfs
q1=0.185//ft
d2=2.5//ft
v=0.91//ft
s1=1.70//ft
s3=1.46//ft
w=0.185//ft
d1=0.30//ft
v1=0.732//ft
//CALCULATIONS
q=d/Q//cfs
Vs=v*d2//fps
Ss=s1*s//percent
Va=v1*d2//fps
```

```
Ss1=s3*s//percent
//RESULTS
printf('the depth and velocity of flow and the
    required slop=% f percent',Ss1)
```

Scilab code Exa 14.5 Example 5

```
clc
//initialisation of variables
d1=0.67//ft
h1=2.00//ft
h2=4.04//ft
hv1=0.062//ft
hv2=0.254//ft
d=0.19//ft
h=0.2//ft
h1=0.04//ft
q=0.644//ft
q1=0.65//ft
v=0.92//ft
d2=6.5//ft
v1=3.69//ft
d3=0.542//ft
hv3=0.21//ft
delv=0.15//ft
d4=0.02//ft
//CALCULATIONS
H=d1+hv1//ft
H1=d1+hv2//ft
he=h*d//ft
hi=d+h1//ft
H2=d3+hv3//ft
he1=h*delv//ft
S=d4+h1//ft
//RESULTS
```

```
printf('the required slope=% f ft',hi)
printf('the lower sewer and the invert drop in the
   transition=% f ft',S)
```

Scilab code Exa 14.6 Example 6

```
clc
//initialisation of variables
q=60//cfs
D=4//ft
w=0.177//ft
s=0.59//ft
h=4.0//ft
d1=1.0//ft
v=0.90//ft
d1=0.42//ft
h1=6.0//ft
h2=1.5//ft
dl=1.3//ft
p=0.41//ft
u=0.8//ft
u1=3.2//ft
y=0.45//ft
//CALCULATIONS
H=s*D//ft
d2=d1*D//ft
V=v*D//ft
P=p*D//ft
D1=y*D//ft
//RESULTS
printf('the critical depth=% f ft',H)
printf('the alternate stages for an energy =% f ft',
   V)
printf('the alternate stages for an energy head=% f
   ft',P)
```

```
printf('the lower alternate stage with upper
    alternate stage=% f ft',D1)
```

Scilab code Exa 14.7 Example 7

```
clc
//initialisation of variables
d=106//cfs
q=400//cfs
d1=0.40//cfs
w=10//ft
//CALCULATIONS
D=d/q//cfs
D1=d1*w//cfs
//RESULTS
printf('the water level in this well rises=% f cfs',
    D1)
```

Scilab code Exa 14.8 Example 8

```
clc
//initialisation of variables
Q=8.07*10^-2//ft
N=0.012//ft
d=0.47//ft
q=10//ft
//CALCULATIONS
D=d*q//ft
//RESULTS
printf('teh water surface in the sewer when it is
    flowing at maximum capacity=% f ft',D)
```

Scilab code Exa 14.9 Example 9

```
clc
//initialisation of variable
g=sqrt(3)//ft
d=5.67//ft
//CALCULATIONS
C=g*d//ft
//RESULTS
printf('The rate of propagation of a discontinuous
   surge=%f ft',C)
```

Scilab code Exa 14.10 Example 10

```
clc
//initialisation of variables
Q1=30//cfs
Q2=16//cfs
a=32//sq ft
r=1.6//ft
i=10^-4//ft
n=1.25*10^-2//ft
h2=0.50//ft
c=3.33//ft
h1=5.20//ft
l=72//ft
s=12320//ft
//CALCULATIONS
L=s-l//ft
//RESULTS
printf('the forchheimer s methos =%f ft',L)
```

Scilab code Exa 14.11 `Example 11`

```
clc
//initialisation of variables
q=1.0//cfs
g=2.0//percent
g1=5.6//percent
r=0.015//cfs
w=90//percent
Q=10*0.9*q//ft
p=0.10//ft
h=(3.48*g1^1/3)//ft
d=p^2/3*100//ft
//CALCULATIONS
D=h*d//in
//RESULTS
printf('The maximum depth of flow in the gutter=% f
   in',D)
```

Chapter 15

Wastewater collection

Scilab code Exa 15.1 Example 1

```
clc
//initialisation of variables
q=0.25//in
Q=0.34//in
r=0.76//in
v=0.83//in
n=0.78//in
r1=0.84//in
v1=0.70//in
w=2//in
q1=0.056//in
d=0.16//in
v2=0.53//in
n1=0.80//in
d1=0.18//in
n2=0.46//in
//CALCULATIONS
V=v*w//fps
N=v1*w//fps
V1=v2*w//fps
V2=n2*w//fps
```

```
//RESULTS
printf('The one fourth their full flow=%f fps',N)
printf('The one enghteenth their full flow=%f fps',
   V2)
```

Scilab code Exa 15.2 Example 2

```
clc
//initialisation of variables
v=2.5//fps
N=0.015//fps
a=(40+27)//in
b=(40*27+27*19)/a
c=0.440//cfs
w=49*0.09/100//cfs
g=0.008//percent
Q=0.82//cfs
r=0.795//cfs
t=2.35*1.16//fps
d1=113.20-113.03//ft
d2=12//ft
//CALCULATIONS
R=r/Q//cfs
D=g*r//in
D2=d1*d2//in
//RESULTS
printf('The required capacity and find the slope
   size and hydraulic characteristics of the system=
   %f in',D2)
```

Scilab code Exa 15.3 Example 3

```
clc
```

```
//initialisation of variables
p=20//min
N=0.012//in
k=2.19//min
l=k+1.97//min
q=340/(60*3.94)//min
r=2.56*0.508//min
del=0.42//min
j=84.28//min
w1=0.92//min
//CALCULATIONS
r1=r*k//cfs
w=p+q//min
G=j-del//min
S=(G-w1)//min
//RESULTS
printf('The required capacity and find the slop size
    and hydraulic=% f min',S)
```

Scilab code Exa 15.4 Example 4

```
clc
//initialisation of variables
a=42//in
d=45//mgd
d1=0.75//in
s=60//ft
p1=9//in
p2=8.4//in
p3=9//in
c1=13*63.6//sq in
c2=9*55.4//sq in
c3=9.21//sq ft
M=d*1.547//cfs
v=M/c3//fps
```

```
g=0.025*32.2//ft/sec^2
//CALCULATIONS
F=v/sqrt(g*(p1/12))//ft
S=s/d1//in
//RESULTS
printf('the port near the end of the diffuser pipe=%
    f in',F)
```

Chapter 16

Machinery and equipment

Scilab code Exa 16.2 `Example 1`

```
clc
//initialisation of variables
p=500//ft
p1=6//in
t=500//cfm
p2=7//psig
P=p2+14.7//psia
T=520*(P/14.7)^0.283//F
f=0.048*p1^0.027/(t)^0.148//in
//CALCULATIONS
delP=20*10^-3*p*T*(t)^2/(38*10^3*P*p1^5)//psia
//RESULTS
printf('the pressure drop=% f psia',delP)
```