

Scilab Textbook Companion for
Water and Wastewater Engineering
by G. M. Fair, J. C. Geyer and D. A. Okun¹

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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.

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Chapter 2

Water system

Scilab code Exa 2.1 Example 1

```
1  clc
2  //initialisation of variables
3  w=3000//sq ft
4  w1=2000//sq ft
5  w2=1000//sq ft
6  r=15//in
7  a=12//in
8  h=7.5//in
9  //CALCULATIONS
10 G=w*(r/a)*h//gal
11 g=w1*(r/a)*h//gal
12 g1=w2*(r/a)*h//gal
13 //RESULTS
14 printf('the normally be stored to tide the supply
    over dry spells=%0 f gal',G)
```

Scilab code Exa 2.2 Example 2

```

1  clc
2  //initialisation of variables
3  m=17.378//mg
4  h=20//in/sq mile
5  d=365//in
6  s=0.75//percent
7  a=100//sq miles
8  p=750000//gpd per sq mile
9  t=180//in
10 c=150//gpcd
11 n=64699 //gpd per sq mile
12 //CALCULATIONS
13 R=h*m//mg
14 A=R/d//mgd
15 S=s*a*t//billion gal
16 Q=a*p/c//gpd
17 P=a*n/c//people against
18 //RESULTS
19 printf('the surface water sheds and storage
    requirements=%f mg',R)
20 printf('the well watered sections of north america=%f
    billion gal',S)
21 printf('the average consumption populations=%f gpd
    ',Q)
22 printf('the presence of proper storage=%f people
    against',P)

```

Scilab code Exa 2.3 Example 3

```

1  clc
2  //initialisation of variables
3  w=20//ft
4  r=3//ft a day
5  g=500//ft
6  g1=1000//ft

```

```

7 h=7.5/1440 // ft
8 p=7.5/1000000 // ft
9 r1=2 // ft a day
10 //CALCULATIONS
11 W1=w*g1*r*h //gpm
12 W2=w*g1*r1*r*p //mgd
13 //RESULTS
14 printf('the ground water laterally =% f gpm',W1)
15 printf('the water from both sides=% f mgd',W2)

```

Scilab code Exa 2.4 Example 4

```

1 clc
2 //initialisation of variables
3 p1=10 //mgd
4 p2=6940 //gpm
5 w=67000 //people
6 d=2 //min
7 v=d*p2/d // gal
8 v1=98.2 //cu ft each
9 q=30 //min
10 q1=q*p2/d // gal
11 q2=13900 //cu ft
12 a=1390 //sq ft
13 s=2 //hr
14 s1=120*p2/d // gal
15 s2=55700 //cu ft
16 s3=s2/8 //sq ft
17 r=3 //gpm/sq ft
18 r1=6 //rapid
19 //CALCULATIONS
20 D=sqrt(v1*4/%pi) // ft
21 S=p2/s3 //gpm/sq ft
22 A=p2/(r1*r) //sq ft
23 //RESULTS

```

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

Scilab code Exa 2.5 Example 5

```
1 clc
2 //initialisation of variables
3 r=10000//ft
4 l=400000//people
5 q=1000000//mgd
6 w=100//gpcd
7 w1=150//gpcd
8 m=50//percent
9 g=1.5//ft
10 h1=2.32//cfs
11 h2=139//cfs
12 d=12//ft
13 c=100//ft
14 l=10.8//ft
15 l2=0.85//ft
16 l1=1000//ft
17 //CALCULATIONS
18 a=r*w/q//mgd
19 b=l*w1/q//mgd
20 a1=a*g//mgd
21 b1=b*g//mgd
22 D=d*sqrt(h1/%pi)//in
23 D1=d*sqrt(h2/%pi)//in
24 L=1/l1//ft
25 L1=l2/l1//ft
26 //RESULTS
27 printf('the higher loss of head in small conduits at
    equal velocity=% f ft',L1)
```

Scilab code Exa 2.6 Example 6

```
1  clc
2  //initialisation of variables
3  a=12//in
4  b=24//in
5  r=500//gpm
6  d=200//gpcd
7  d1=150//gpcd
8  p1=113//sq in
9  p2=425//sq in
10 v1=3//fps
11 v2=2.35//cfs
12 v3=9.42//cfs
13 h=646000//gpd
14 w=720000//gpd
15 //CALCULATIONS
16 D1=v2*h//gpd
17 D2=v3*h//gpd
18 W1=D1-w//gpd
19 W2=D2-w//gpd
20 R1=D1/d//people
21 R2=D2/d//people
22 S=W1/d1//people
23 S1=W2/d1//people
24 //RESULTS
25 printf('the absence of fire service for a maximum
    draft=%f gpd',D2)
26 printf('The residential fire flow requirements=%f f
    gpd',W2)
```

Scilab code Exa 2.7 Example 7

```
1  clc
2  //initialisation of variables
3  w=100000 //ft
4  c=250 //per capita
5  p1=0.3 //percent
6  p2=0.1 //percent
7  p3=0.60 //percent
8  w1=15 //mgd
9  //CALCULATIONS
10 T=c*w // $
11 W=p1*T // $
12 W1=p2*T // $
13 W2=p3*T // $
14 W3=((w1)^2/3)*T // $
15 //RESULTS
16 printf('the replacement cost of the water of a city=
    % f $',W3)
```

Chapter 3

Wastewater systems

Scilab code Exa 3.1 Example 1

```
1  clc
2  //initialisation of variables
3  v=2.5//fps
4  c=0.013//gpd
5  p=300//gpd
6  d=50//per care
7  m=5.20//ft
8  a=1000//ft
9  //CALCULATIONS
10 C=[(%pi*64)/(4*144)]*v*646000//gpd
11 M=m/a//ft
12 P=C/p
13 A=P/d//acres
14 //RESULTS
15 printf('the acres will it drain if the population
        density=%g f acres ',A)
```

Scilab code Exa 3.2 Example 2

```

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

```

Scilab code Exa 3.3 Example 3

```

1  clc
2  //initialisation of variables
3  w=1.0// cfs
4  w1=3.0// cfs
5  w2=45.0// cfs
6  v=3.0//fps
7  h=144// ft
8  D=12*sqrt(4*w/(%pi*w1))//in
9  d1=1.95// cfs
10 D1=12*sqrt(4*d1)/(%pi*v)//in
11 d2=41.6// cfs
12 D2=12*sqrt(4*d2)/(%pi*w1)//ins
13 //CALCULATIONS
14 C=%pi*(D)^2*3/(4*h)// cfs

```



```

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

```

Scilab code Exa 3.4 Example 4

```

1  clc
2  //initialisation of variables
3  t=0.8 //mgd
4  d=8000 //people
5  a=2 //hr
6  v=800000 //ft
7  h=10 //ft
8  a1=4 //in
9  d1=1 //sq ft per capita
10 a3=3 //mgad
11 //CALCULATIONS
12 V=v*(a/24)/a // gal
13 S=V/h //sq ft
14 S1=(v/h)/S //gpd per sq ft
15 V1=a*d/h //cu ft
16 D=d/S //ft
17 E=d1*d/a1 //sq ft
18 A=t/a3 //acre
19 //RESULTS
20 printf('the capacity of the components of a small
    trickling-filter =% f acre ',A)

```

Scilab code Exa 3.5 Example 5

```
1 clc
2 //initialisation of variables
3 w=2000//sq miles
4 r=0.1//cfs
5 d=80000//ft
6 p=100//gpd
7 p1=80//ft
8 p2=340//percent
9 h=646000//ft
10 //CALCULATIONS
11 L=r*w//cfs
12 R=6*p1/1.4//cfs
13 P=p1*(p2-L)/p2//percent
14 D=(d*p)//gpd
15 D1=(L*h)//gpd
16 //RESULTS
17 printf('the percent of removal of pollutional load
    needed=%0 f percent ',P)
```

Scilab code Exa 3.6 Example 6

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

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

Scilab code Exa 3.7 Example 7

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

Chapter 4

Information analysis

Scilab code Exa 4.1 Example 1

```
1 clc
2 //initialisation of variables
3 y=19.5//in
4 x=396.8//in
5 n=6//in
6 y1=2.20//in
7 x1=51.14//in
8 p=5.64//in
9 //CALCULATIONS
10 Beta=(x-n*(y)*(y1))/(x1-n*(y1)^2)
11 X=p+Beta//minimum
12 //RESULTS
13 printf('the method of leate squares =% f minimum',X)
```

Scilab code Exa 4.3 Example 2

```
1 clc
2 //initialisation of variables
```

```

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

```

Scilab code Exa 4.5 Example 3

```

1 clc
2 //initialisation of variables
3 a=4404//ft
4 q=9//ft
5 mu=12//ft
6 //CALCULATIONS
7 F=sqrt(a/q)//ft
8 CF=F/mu*100//percent
9 //RESULTS
10 printf('the coefficient of fluctuation is =%f f
        percent ',CF)

```

Scilab code Exa 4.7 Example 4

```

1 clc
2 //initialisation of variables
3 h2=5//in
4 x=3.72//in
5 x1=1.28//in
6 //CALCULATIONS
7 H=h2*x1/x//in

```

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

Scilab code Exa 4.8 Example 5

```
1 clc
2 //initialisation of variables
3 p=80//in
4 q=20//in
5 //CALCULATIONS
6 K=p+q//ft
7 //RESULTS
8 printf('the moments of the arithmetically normal
      frequency curve=%f f ft ',K)
```

Scilab code Exa 4.9 Example 6

```
1 clc
2 //initialisation of variables
3 g=3.2541//in
4 g1=3.46//in
5 m=0.5390//ft
6 h=2/99//ft
7 p=1.52//ft
8 //CALCULATIONS
9 L=sqrt(g*h)//in
10 mu=g1*p//in
11 M=g1/p//percent
12 //RESULTS
13 printf('the points necessary to plot the straight
      line of fit on log probability=%f percent ',M)
```

Chapter 5

Water and wastewater volume

Scilab code Exa 5.1 Example 1

```
1  clc
2  //initialisation of variables
3  t1=5.25//yr
4  t2=10.00//yr
5  yi=171000//in
6  ye=111000//in
7  yt=5.23300//in
8  yl=5.04532//in
9  yn=31500//in
10 ym=0.09853//in
11 tm=9.25//yr
12 tn=10.00//yr
13 //CALCULATIONS
14 T=t1/t2//yr
15 T1=tm/tn//yr
16 Y=yi-ye//in
17 Yt=yt-yl//in
18 //RESULTS
19 printf('the fifth intercensal year =% f yr ',T)
20 printf('the ninth postcensal year =% f yr ',T1)
```

Scilab code Exa 5.2 Example 2

```
1  clc
2  //initialisation of variables
3  y0=30000 //in
4  y1=172000 //in
5  y2=292000 //in
6  a=172 //ft
7  p=30 //ft
8  y=292 //ft
9  q=322000 //ft
10 g=313 //ft
11 n=0.05 //ft
12 d=-2.442 //ft
13 //CALCULATIONS
14 L=[2*p*a*y2-(a)^2*q]/[p*y-(a)^2] //moreover
15 m=(g-p)/p //ft
16 N=n*d //in
17 Y=g/[1+m*(N)] //in
18 //RESULTS
19 printf('the saturation populations=%f moreover',L)
20 printf('the coefficients=%f in',N)
21 printf('the equation of a logistic curve=%f in',Y)
```

Scilab code Exa 5.4 Example 3

```
1  clc
2  //initialisation of variables
3  p=100000 //in
4  d=150 //in
5  h=1000000 //in
6  a1=2.0 //draft
```



```

7 a2=3.0 // draft
8 a3=1.6 // draft
9 m=1.5 // in
10 q=2.5 // in
11 v=1020 // in
12 w=100 // in
13 t=0.01 // in
14 v1=13.2 // mgd
15 //CALCULATIONS
16 A=d*p/h // mgd
17 M=m*A // mgd
18 M1=q*A // mgd
19 V=v*sqrt(w)*(1-t*sqrt(w)) // gpm
20 D=M+v1 // mgd
21 L=a1*A // mgd
22 L1=(4/3)*M // max
23 H=a2*A // mgd
24 H1=(4/3)*M1 // max
25 F=a3*A // mgd
26 F1=(4/3)*M // max
27 //RESULTS
28 printf('the resulting capacities of the four system
    =% f max',F1)

```

Scilab code Exa 5.6 Example 4

```

1 clc
2 //initialisation of variables
3 r=48 // in
4 A=450 // gpd/acre
5 B=8000 // gpd/mile
6 S=5280/350 // manholes/mile
7 //CALCULATIONS
8 C=(B-S*100)/12 // gpd/mile
9 //RESULTS

```

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

Scilab code Exa 5.7 Example 5

```
1 clc
2 //initialisation of variables
3 p1=20//ft
4 p2=30//ft
5 w=5//person
6 s=17800//in
7 h=1200//in
8 q=100//in
9 i=1//in
10 //CALCULATIONS
11 S=p1*p2*i*s/(h*w)//gpcd
12 P=(q*p1*p2/S)//percent
13 //RESULTS
14 printf('the degree of separation of stormwater=% f
    percent ',P)
```

Scilab code Exa 5.8 Example 6

```
1 clc
2 //initialisation of variables
3 s=105//gpcd
4 m=315//gpcd
5 m1=35//gpcd
6 Q1=360//gpcd
7 Q2=30//gpcd
8 p1=20//percent
9 p2=15//persons/acer
10 D=21//persons/acre
```

```
11 I=2000 //gpd/acre
12 //CALCULATIONS
13 A=D*(s+Q2)+I //gpd/acre
14 R=D*(m+Q2)+I //gpd/acre
15 L=D*(m1+Q2)+I //gpd/acre
16 //RESULTS
17 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

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

Scilab code Exa 6.2 Example 2

```

1  clc
2  //initialisation of variables
3  t=60//f
4  v=0.52//in
5  t1=80//F
6  p=40//percent
7  v1=1.03*0.40//in
8  w=8//mph
9  pa=29.0//in
10 p1=0.497//ft
11 q=1.32*10-2//ft
12 r=0.268//ft
13 //CALCULATIONS
14 E=p1*(1-q*pa)*(1+r*w)*(v-v1)//in
15 //RESULTS
16 printf('the evaporation for the a day during=%f in '
    ,E)

```

Scilab code Exa 6.3 Example 3

```

1  clc
2  //initialisation of variables
3  t=47//f
4  q=8000//ft
5  a=100//ft
6  d=0.10//in
7  d1=7//degree days
8  s1=14000//ft
9  s2=7000//ft
10 s=1000//ft
11 g=32//ft
12 h=17.37//ft
13 h1=1.547//ft
14 //CALCULATIONS
15 T=q+s*(t-g)/3//ft

```

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

Chapter 7

Rainfall and runoff

Scilab code Exa 7.5 Example 1

```
1  clc
2  //initialisation of variables
3  n=20 //ft
4  s=sqrt(12676/19) // ft
5  c=45.5 // ft
6  q=551400 // ft
7  q1=12700 // ft
8  h=8.5 // ft
9  w=s/c // ft
10 //CALCULATIONS
11 D=q/(2*s*q1) // cfs
12 D1=D*(1+h/n) // cfs
13 //RESULTS
14 printf('the record runoff of a stream draining=%0 f
        cfs ',D1)
```

Scilab code Exa 7.6 Example 2

```

1  clc
2  //initialisation of variables
3  i=16/(62)^0.66//in hr
4  q=(16*10^0.31)/(62)^0.66//in hr
5  c=1.0//max
6  C1=c*(0.01)^0.31//in
7  C2=c*(0.1)^0.31//in
8  x1=640//cfs
9  //CALCULATIONS
10 Y1=C1*i*c*x1//cfs
11 Y2=C2*q*c*x1//cfs
12 //RESULTS
13 printf('the time of concentration=%0 f cfs ',Y2)

```

Scilab code Exa 7.8 Example 3

```

1  clc
2  //initialisation of variables
3  d=163*48.5//cfs
4  a=48.5//ft
5  q=100//cfs
6  Q=45.5*a//cfs
7  c=0.57//cfs
8  v=1.8//cfs
9  p=0.45//ft
10 //CALCULATIONS
11 P=d/(q*sqrt(a))//percent
12 C=Q/(a^0.8*(1+2*a^-0.3))//cfs
13 d1=2.6//cfs
14 T=(1-p*c+v*c*2)//cfs
15 //RESULTS
16 printf('the meyers rating =%0 f percent ',P)
17 printf('the magnitude of the maximum peak flood =%0 f
    cfs ',T)

```

Chapter 8

Storage and runoff control

Scilab code Exa 8.2 Example 1

```
1  clc
2  //initialisation of variables
3  a=0.75//ft
4  p=123//mg
5  v=100//ft
6  s=33//mg
7  s1=67//mg
8  d=26.6//mgd
9  d1=0.0477//mgd
10 q=0.750//gpd/sq mile
11 d2=365//days
12 //CALCULATIONS
13 S=p/a//mg per sq mile
14 Cv=v*s/s1//percent
15 M=d*d1//mgd per sq mile
16 D=v*q/M//MAF
17 D1=(v*p)/(M*d2)//MAF
18 R=p/q//days
19 //RESULTS
20 printf('the use monthly averages rather than daily
    stream flow=%0 f days',R)
```

Scilab code Exa 8.3 Example 2

```
1 clc
2 //initialisation of variables
3 d=750000//gpd per sq mile
4 v=0.22//ft
5 a=1.27//ft
6 q=0.30//ft
7 d1=365//days
8 p=0.25//ft
9 //CALCULATIONS
10 Q=q*a*d1//mg/sq mile
11 H=p*a*d1//mg/sq mile
12 //RESULTS
13 printf('the results obtained by normal analytical
    procedures and by Hazen s=% f mg/sq mile ',H)
```

Scilab code Exa 8.4 Example 3

```
1 clc
2 //initialisation of variables
3 d=30.0//mgd
4 a=40.0//sq miles
5 a1=1500//acres
6 r1=47.0//in
7 r2=27.0//in
8 q=0.9//in
9 k=640//in
10 h=0.052//gpd/sq mile
11 //CALCULATIONS
12 Q=r2-(r2+a-r1)*q*a1/(k*a)//in
```

```

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

```

Scilab code Exa 8.6 Example 4

```

1 clc
2 //initialisation of variables
3 p=100//ft
4 q=27000//acre-ft
5 p1=10//ft
6 s=8250//acre-ft
7 //CALCULATIONS
8 R=p*s/q//percent
9 //RESULTS
10 printf('the ratio of peak inflow from fuller values=
    %g f percent ',R)

```

Chapter 9

Groundwater flow

Scilab code Exa 9.1 Example 1

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

Scilab code Exa 9.2 Example 2

```
1 clc
2 //initialisation of variables
3 p1=1000//ft
4 p2=50//ft
```

```

5 g=20 // ft / mile
6 v=5280 // ft
7 q=7.5*10^-6 // ft
8 t=60 // F
9 k=2835 // ft / days
10 p=7.5 // ft
11 //CALCULATIONS
12 S=g/v // ft
13 W=k*(g/v) // ft / day
14 Q=W*p1*p2*q // mgd
15 P=k*p // ft
16 P1=P*p2 // mgd
17 //RESULTS
18 printf('the velocity of flow =% f mgd',Q)
19 printf('the standard coefficient pf permeability=% f
      mgd',P1)

```

Scilab code Exa 9.3 Example 3

```

1 clc
2 //initialisation of variables
3 p=40 // ft
4 d=56 // ft
5 d1=140 // ft
6 p1=30 // ft
7 w=3.28*10^-4 // fps
8 //CALCULATIONS
9 Q=w*(p/d1)*2*d*p // cfs
10 q=Q/p // cfs
11 K=w*(p/d1) // fps
12 x0=q/(2*%pi*K) // ft
13 Z=2*%pi*x0 // ft
14 //RESULTS
15 printf('the yield of the well if the coefficient of
      permeability=% f ft',x0)

```

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

Scilab code Exa 9.4 Example 4

```
1 clc
2 //initialisation of variables
3 p=5*10^6//ft
4 Q=350//gpm
5 x=225//ft
6 u=10^-2//ft
7 g=1.87//ft
8 p2=7*10^2//ft
9 p3=10.9//ft
10 w=4.0//ft
11 t=114.6//ft
12 d=10//ft
13 p1=5//ft
14 w1=3.2*10^4//ft
15 W=21.75//ft
16 //CALCULATIONS
17 T=t*Q*4/p1//gpd/ft
18 S=u*(w1)/[g*(p)]//ft
19 U=g*[(S)/(T)]*(x^2/d)//ft
20 P=t*(p2)*p3/(T)//ft
21 U1=g*[(S)/(T)]*(1/d)//ft
22 P1=t*(p2)*W/(T)//ft
23 //RESULTS
24 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

```

1  clc
2  //initialisation of variables
3  Q=350 //gpm
4  x=225 // ft
5  t=1 //min
6  p=1.6 // ft
7  t2=10 //min
8  p2=4.5 // ft
9  p3=700 //gpm
10 T=3.2*104 //gpd/ ft
11 t0=0.3 //min
12 u=1.15*10-5
13 //CALCULATIONS
14 S=t0*(T)*t0/[(x)2*1440] // ft
15 P=[(114.6*p3)/(T)]*(-0.5772*2.3*log(u)) // ft
16 //RESULTS
17 printf('A straight line being drawn through the
    ppints for the higher=% f ft ',P)

```

Scilab code Exa 9.6 Example 6

```

1  clc
2  //initialisation of variables
3  h=4.8 //ft
4  m=13.4 //ft
5  k=10-1 //cm/sec
6  k1=3.28*10-3 //fps
7  n=7 //ft
8  n1=11 //ft
9  q=1.0*10-2
10 //CALCULATIONS
11 Q=k1*h*n/n1 // cfs/ft
12 Q1=2*q*102 // cfs
13 //RESULTS
14 printf('A satisfactory orthogonal system the flow of

```

into the collector $\approx \%$ f cfs', Q1)

Chapter 10

Groundwater collection

Scilab code Exa 10.1 Example 1

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

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

Scilab code Exa 10.3 Example 2

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

Chapter 11

Surface water collections

Scilab code Exa 11.1 Example 1

```
1  clc
2  //initialisation of variables
3  s=20//mph
4  t=90//min
5  w=1.31//ft
6  h=7.5//miles
7  h1=0.22//ft
8  t1=1100//min
9  t2=6.0//min
10 p=32.2//ft
11 l=5.12//length
12 l1=2.8//length
13 p1=1400//ft
14 d=73//depth
15 h3=2.06//ft
16 e=173.0//ft
17 hi=0.2//ft
18 //CALCULATIONS
19 W=s*w//mph
20 hs=h1*[(W)^2/p]^0.53*h^0.47//ft
21 Ts=t2*(W/p)^0.44*(h/p)^0.28//sec
```

```

22 Td=t1*h/(p*Ts) //min
23 Ls=l1/(1*(Ts)^2) // ft
24 D=d/(1*(Ts)^2) // ft
25 H=(W)^2*[h*(1/(p1*d)))] // ft
26 hr=h3*l1 // ft
27 M=e+hi+hr // ft
28 //RESULTS
29 printf('the overwater wind speed=%g f mph',W)
30 printf('the significant wave height=%g f ft ',hs)
31 printf('the significant wave period=%g f sec ',Ts)
32 printf('the minimum wind duration required to reach
the significant wave height=%g f min ',Td)
33 printf('the significant wave lenght adn steepness=%g
f ft ',Ls)
34 printf('the reservoir depth ratio=%g f ft ',D)
35 printf('the wind tide or set up=%g f ft ',H)
36 printf('the run up =%g f ft ',hr)
37 printf('the maximum elevation reached by the waves=%g
f ft ',M)

```

Scilab code Exa 11.2 Example 2

```

1 clc
2 //initialisation of variables
3 g=264 //quartz
4 p=0.39 //percent
5 //CALCULATIONS
6 S=(1-p)*(g-1) //in
7 //RESULTS
8 printf('the hydraulic gradient and seepage velocity=%g
f in ',S)

```

Scilab code Exa 11.3 Example 3

```

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

```

Scilab code Exa 11.4 Example 4

```

1  clc
2  //initialisation of variables
3  d=120//ft
4  w=16//ft
5  d1=120/0.8//ft
6  p=60*0.8//ft
7  h=2//ft
8  v=18.74*0.8//ft
9  s=95.23//ft

```

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

Chapter 12

Water transmission

Scilab code Exa 12.1 Example 1

```
1 clc
2 //initialisation of variables
3 c=100//in
4 a=10//in
5 Q=0.976//ft
6 //CALCULATIONS
7 G=a*Q//ft
8 //RESULTS
9 printf('the graphical basic =% f ft ',G)
```

Scilab code Exa 12.2 Example 2

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

```

7 R=d/4//ft
8 A=(%pi*d^2)/4//sq ft
9 //RESULTS
10 printf('The diameter hydraulics radius and area of
    the hydraulically equivalent circular conduit=%0 f
    sq ft ',A)

```

Scilab code Exa 12.3 Example 3

```

1 clc
2 //initialisation of variables
3 h1=13.5//ft
4 h2=19.0//ft
5 h3=27.5//ft
6 c1=2.0*10^4//ft
7 c2=2.1*10^4//ft
8 c3=2.2*10^4//ft
9 //CALCULATIONS
10 H=h1+h2+h3//ft
11 C=c1+c2+c3//ft
12 //RESULTS
13 printf('the most economical distributions of the
    available head=%0 f ft ',C)

```

Scilab code Exa 12.4 Example 4

```

1 clc
2 //initialisation of variables
3 p=60//in
4 h=20//percent
5 a=1000//ft
6 h1=40//percent
7 c=0.5//ft

```



```

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

```

Scilab code Exa 12.5 Example 5

```

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

```

Chapter 13

Water distribution

Scilab code Exa 13.2 Example 1

```
1  clc
2  //initialisation of variables
3  p1=7.8//ft
4  p2=6.0//ft
5  p3=7.4//ft
6  p4=6.5//ft
7  p=7.6//ft
8  h=1.0//ft
9  h1=6.7//ft
10 p5=3.3//ft
11 //CALCULATIONS
12 D=p1-p2//mgd
13 D1=p1-p3//mgd
14 D2=p-p4//mgd
15 D3=p4+h//mgd
16 D4=h1-p5//mgd
17 //RESULTS
18 printf('the demand is taken =% f mgd',D3)
```

Scilab code Exa 13.3 Example 2

```
1  clc
2  //initialisation of variables
3  w=500 // ft
4  p=20 // psig
5  h=40 // psig
6  h1=1000 // in
7  q=1250 // ft
8  g=2.308/0.75 // ft
9  g1=2.308/1.00 // ft
10 s=5200 //gpm
11 a=250 //gpm
12 //CALCULATIONS
13 H=[h1-(1/2)*(w)] // ft
14 H1=(h-p)*g // percent
15 Q=[q-(1/2)*(w)] // ft
16 Q1=(h-p)*g1 // percent
17 S=s/a //gpm
18 //RESULTS
19 printf('the number of standard fire streams=%f gpm',
    ,S)
```

Scilab code Exa 13.6 Example 3

```
1  clc
2  //initialisation of variables
3  h1=2.1*3 // ft
4  h2=2.1 // ft
5  h=8.4 // ft
6  p=1000 // ft
7  h3=5.7 // ft
8  h4=4.2*3 // ft
9  q=4.2 // ft
10 s=1.68 // ft
```

```

11 q1=1.33 // ft
12 //CALCULATIONS
13 A=p*h/h2 // ft
14 B=p*(h3+h4)/q // ft
15 C=p*(h1+h2)/s // ft
16 //RESULTS
17 printf('the equivalent pipe for the Hazen willians
    coefficient=% f ft ',A)
18 printf('the equivalent pipe for the Hazen willians
    coefficient=% f ft ',B)
19 printf('the equivalent pipe for the Hazen willians
    coefficient=% f ft ',C)

```

Scilab code Exa 13.8 Example 4

```

1 clc
2 //initialisation of variables
3 d=10 //hr
4 p=50000 //in
5 a=7.5 //mgd
6 w=0.75 //mg
7 s=5.03 //mg
8 //CALCULATIONS
9 S=s/w //mg
10 P=S-s //mg
11 //RESULTS
12 printf('a steady gravity supply equal to maximum
    daily=% f mg ',P)

```

Chapter 14

Wastewater flows

Scilab code Exa 14.1 Example 1

```
1  clc
2  //initialisation of variables
3  n=0.013//ft
4  s=4.90//ft
5  v=0.590//ft
6  d=0.463//ft
7  w=3.9*10^-2//ft
8  p=1.696//ft
9  //CALCULATIONS
10 V=s*v//fps
11 Q=s*d//cfs
12 N=(w*p)^2*1000//percent
13 //RESULTS
14 printf('the velocity of flow and rate of discharge=%  
f percent ',N)
```

Scilab code Exa 14.2 Example 2

```

1  clc
2  //initialisation of variables
3  v=1.34//fps
4  s=3.7*10^-3//fps
5  k=0.8//ft
6  r=20//ft
7  k1=0.04//ft
8  v=3.0//fps
9  v1=5.0//fps
10 d=10^-1//ft
11 d1=1.34//ft
12 //CALCULATIONS
13 K=r*k1//ft
14 V=sqrt(r)//times
15 D=d*(v/d1)^2//cm
16 D1=d*(v1/d1)^2//cm
17 //RESULTS
18 printf('the minimum velocity and the gradient at the
        which coarse quartz=% f cm',D1)

```

Scilab code Exa 14.3 Example 3

```

1
2
3  clc
4  //initialisation of variables
5  v=2.5//fps
6  q=0.873//cfs
7  s=5.20//percent
8  a=0.252//ft
9  r=0.684//ft
10 r1=1.46//ft
11 v1=0.776//ft
12 q1=0.196//ft
13 n=0.78//ft

```

```

14 R=0.939//ft
15 //CALCULATIONS
16 V=v1*v//fps
17 Q=q1*q//cfs
18 R1=r1*s//percent
19 Vs=R*v//ft
20 N=n*Vs//fps
21 Qs=a*R*q//cfs
22 N1=n*Qs//cfs
23 //RESULTS
24 printf('the required grades and associated velocity
    and rates=%0 f cfs ',V)
25 printf('the depth and a grade=%0 f cfs ',Q)
26 printf('the self cleaning flow=%0 f cfs ',N1)

```

Scilab code Exa 14.4 Example 4

```

1 clc
2 //initialisation of variables
3 Q=0.873//cfs
4 s=5.20//percent
5 d=0.161//cfs
6 q1=0.185//ft
7 d2=2.5//ft
8 v=0.91//ft
9 s1=1.70//ft
10 s3=1.46//ft
11 w=0.185//ft
12 d1=0.30//ft
13 v1=0.732//ft
14 //CALCULATIONS
15 q=d/Q//cfs
16 Vs=v*d2//fps
17 Ss=s1*s//percent
18 Va=v1*d2//fps

```

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

Scilab code Exa 14.5 Example 5

```
1 clc
2 //initialisation of variables
3 d1=0.67//ft
4 h1=2.00//ft
5 h2=4.04//ft
6 hv1=0.062//ft
7 hv2=0.254//ft
8 d=0.19//ft
9 h=0.2//ft
10 h1=0.04//ft
11 q=0.644//ft
12 q1=0.65//ft
13 v=0.92//ft
14 d2=6.5//ft
15 v1=3.69//ft
16 d3=0.542//ft
17 hv3=0.21//ft
18 delv=0.15//ft
19 d4=0.02//ft
20 //CALCULATIONS
21 H=d1+hv1//ft
22 H1=d1+hv2//ft
23 he=h*d//ft
24 hi=d+h1//ft
25 H2=d3+hv3//ft
26 he1=h*delv//ft
27 S=d4+h1//ft
28 //RESULTS
```



```

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

```

Scilab code Exa 14.6 Example 6

```

1  clc
2  //initialisation of variables
3  q=60//cfs
4  D=4//ft
5  w=0.177//ft
6  s=0.59//ft
7  h=4.0//ft
8  d1=1.0//ft
9  v=0.90//ft
10 d1=0.42//ft
11 h1=6.0//ft
12 h2=1.5//ft
13 d1=1.3//ft
14 p=0.41//ft
15 u=0.8//ft
16 u1=3.2//ft
17 y=0.45//ft
18 //CALCULATIONS
19 H=s*D//ft
20 d2=d1*D//ft
21 V=v*D//ft
22 P=p*D//ft
23 D1=y*D//ft
24 //RESULTS
25 printf('the critical depth=%f ft ',H)
26 printf('the alternate stages for an energy =%f ft ',
    V)
27 printf('the alternate stages for an energy head=%f
    ft ',P)

```

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

Scilab code Exa 14.7 Example 7

```
1 clc  
2 //initialisation of variables  
3 d=106 // cfs  
4 q=400 // cfs  
5 d1=0.40 // cfs  
6 w=10 // ft  
7 //CALCULATIONS  
8 D=d/q // cfs  
9 D1=d1*w // cfs  
10 //RESULTS  
11 printf('the water level in this well rises=%f cfs ',  
D1)
```

Scilab code Exa 14.8 Example 8

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

Scilab code Exa 14.9 Example 9

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

Scilab code Exa 14.10 Example 10

```
1 clc
2 //initialisation of variables
3 Q1=30//cfs
4 Q2=16//cfs
5 a=32//sq ft
6 r=1.6//ft
7 i=10^-4//ft
8 n=1.25*10^-2//ft
9 h2=0.50//ft
10 c=3.33//ft
11 h1=5.20//ft
12 l=72//ft
13 s=12320//ft
14 //CALCULATIONS
15 L=s-1//ft
16 //RESULTS
17 printf('the forchheimer s methos =%f ft ',L)
```

Scilab code Exa 14.11 Example 11

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

Chapter 15

Wastewater collection

Scilab code Exa 15.1 Example 1

```
1  clc
2  //initialisation of variables
3  q=0.25//in
4  Q=0.34//in
5  r=0.76//in
6  v=0.83//in
7  n=0.78//in
8  r1=0.84//in
9  v1=0.70//in
10 w=2//in
11 q1=0.056//in
12 d=0.16//in
13 v2=0.53//in
14 n1=0.80//in
15 d1=0.18//in
16 n2=0.46//in
17 //CALCULATIONS
18 V=v*w//fps
19 N=v1*w//fps
20 V1=v2*w//fps
21 V2=n2*w//fps
```

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

Scilab code Exa 15.2 Example 2

```
1 clc
2 //initialisation of variables
3 v=2.5 //fps
4 N=0.015 //fps
5 a=(40+27) //in
6 b=(40*27+27*19)/a
7 c=0.440 //cfs
8 w=49*0.09/100 //cfs
9 g=0.008 //percent
10 Q=0.82 //cfs
11 r=0.795 //cfs
12 t=2.35*1.16 //fps
13 d1=113.20-113.03 //ft
14 d2=12 //ft
15 //CALCULATIONS
16 R=r/Q //cfs
17 D=g*r //in
18 D2=d1*d2 //in
19 //RESULTS
20 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

```
1 clc
```

```

2 //initialisation of variables
3 p=20//min
4 N=0.012//in
5 k=2.19//min
6 l=k+1.97//min
7 q=340/(60*3.94)//min
8 r=2.56*0.508//min
9 del=0.42//min
10 j=84.28//min
11 w1=0.92//min
12 //CALCULATIONS
13 r1=r*k//cfs
14 w=p+q//min
15 G=j-del//min
16 S=(G-w1)//min
17 //RESULTS
18 printf('The required capacity and find the slop size
        and hydraulic=%0 f min',S)

```

Scilab code Exa 15.4 Example 4

```

1 clc
2 //initialisation of variables
3 a=42//in
4 d=45//mgd
5 d1=0.75//in
6 s=60//ft
7 p1=9//in
8 p2=8.4//in
9 p3=9//in
10 c1=13*63.6//sq in
11 c2=9*55.4//sq in
12 c3=9.21//sq ft
13 M=d*1.547//cfs
14 v=M/c3//fps

```

```
15 g=0.025*32.2//ft/sec^2
16 //CALCULATIONS
17 F=v/sqrt(g*(p1/12))//ft
18 S=s/d1//in
19 //RESULTS
20 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

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