

Scilab Textbook Companion for
Hydraulics Made Easy
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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 | 4 |
| 1 Hydrostatics | 5 |
| 2 Flootation and Buoyancy | 18 |
| 3 Flow of Water | 23 |
| 4 Flow of Water through Orifices and Mouthpieces | 30 |
| 5 Flow of water over Weirs | 43 |
| 6 Flow of water through pipes | 52 |
| 7 Flow through Open channels | 72 |
| 8 Impact of Jets | 82 |
| 9 Viscous flow | 89 |
| 10 Miscellaneous Problems | 93 |

List of Scilab Codes

| | | |
|----------|----------------------|----|
| Exa 1.1 | example 1 | 5 |
| Exa 1.2 | example 2 | 5 |
| Exa 1.3 | example 3 | 6 |
| Exa 1.4 | example 4 | 6 |
| Exa 1.5 | example 5 | 7 |
| Exa 1.6 | example 6 | 7 |
| Exa 1.7 | example 7 | 8 |
| Exa 1.8 | example 8 | 8 |
| Exa 1.9 | example 9 | 9 |
| Exa 1.10 | example 10 | 9 |
| Exa 1.11 | example 11 | 10 |
| Exa 1.12 | example 12 | 10 |
| Exa 1.13 | example 13 | 11 |
| Exa 1.14 | example 14 | 12 |
| Exa 1.15 | example 15 | 12 |
| Exa 1.16 | example 16 | 13 |
| Exa 1.17 | example 17 | 13 |
| Exa 1.18 | example 18 | 14 |
| Exa 1.19 | example 19 | 14 |
| Exa 1.22 | example 22 | 15 |
| Exa 1.25 | example 25 | 15 |
| Exa 1.26 | example 26 | 16 |
| Exa 1.27 | example 27 | 16 |
| Exa 2.1 | example 1 | 18 |
| Exa 2.3 | example 3 | 19 |
| Exa 2.4 | example 4 | 19 |
| Exa 2.7 | example 7 | 19 |
| Exa 2.8 | example 8 | 20 |

| | | |
|----------|--------------------------------|----|
| Exa 2.9 | example 9 | 20 |
| Exa 2.10 | example 10 | 21 |
| Exa 2.11 | example 11 | 22 |
| Exa 3.1 | example 1 | 23 |
| Exa 3.2 | example 2 | 23 |
| Exa 3.3 | example 3 | 24 |
| Exa 3.4 | example 4 | 25 |
| Exa 3.5 | example 5 | 25 |
| Exa 3.6 | example 6 | 26 |
| Exa 3.7 | example 7 | 26 |
| Exa 3.8 | example 8 | 27 |
| Exa 3.9 | example 9 | 27 |
| Exa 3.10 | example 10 | 28 |
| Exa 3.12 | example 12 | 29 |
| Exa 4.1 | chapter 4 example 1 | 30 |
| Exa 4.2 | chapter 4 example 2 | 31 |
| Exa 4.3 | chapter 4 example 3 | 32 |
| Exa 4.4 | chapter 4 example 4 | 32 |
| Exa 4.5 | chapter 4 example 5 | 33 |
| Exa 4.6 | chapter 4 example 6 | 33 |
| Exa 4.7 | example 7 | 34 |
| Exa 4.8 | chapter 4 example 8 | 34 |
| Exa 4.9 | example 9 | 35 |
| Exa 4.10 | example 10 | 35 |
| Exa 4.11 | example 11 | 36 |
| Exa 4.12 | chapter 4 example 12 | 37 |
| Exa 4.13 | chapter 4 example 13 | 37 |
| Exa 4.14 | chapter 4 example 14 | 38 |
| Exa 4.15 | example 15 | 38 |
| Exa 4.16 | example 16 | 39 |
| Exa 4.17 | example 17 | 39 |
| Exa 4.18 | example 18 | 40 |
| Exa 4.19 | example 19 | 40 |
| Exa 4.20 | example 20 | 41 |
| Exa 4.21 | example 21 | 41 |
| Exa 5.1 | chapter 5 example 1 | 43 |
| Exa 5.2 | example 2 | 43 |
| Exa 5.3 | chapter 5 example 3 | 44 |

| | | |
|----------|-------------------------------|----|
| Exa 5.4 | chapter 5 example 4 | 44 |
| Exa 5.5 | chapter 5 example 5 | 45 |
| Exa 5.6 | chapter 5 example 6 | 45 |
| Exa 5.7 | chapter 5 example 7 | 46 |
| Exa 5.8 | example 1 | 46 |
| Exa 5.9 | example 9 | 47 |
| Exa 5.10 | example 10 | 48 |
| Exa 5.11 | example 11 | 48 |
| Exa 5.12 | example 12 | 49 |
| Exa 5.13 | example 13 | 49 |
| Exa 5.14 | example 14 | 50 |
| Exa 5.16 | example 16 | 50 |
| Exa 6.1 | chapter 6 example 1 | 52 |
| Exa 6.2 | chapter 6 example 2 | 52 |
| Exa 6.3 | chapter 6 example 3 | 53 |
| Exa 6.4 | chapter 6 example 4 | 53 |
| Exa 6.5 | chapter 6 example 5 | 54 |
| Exa 6.6 | example 6 | 55 |
| Exa 6.7 | example 7 | 55 |
| Exa 6.8 | example 8 | 56 |
| Exa 6.9 | example 9 | 57 |
| Exa 6.10 | example 10 | 57 |
| Exa 6.11 | example 11 | 58 |
| Exa 6.12 | example 12 | 59 |
| Exa 6.13 | example 13 | 59 |
| Exa 6.14 | example 14 | 60 |
| Exa 6.15 | example 15 | 60 |
| Exa 6.16 | example 16 | 61 |
| Exa 6.17 | example 17 | 61 |
| Exa 6.19 | example 19 | 62 |
| Exa 6.20 | example 20 | 63 |
| Exa 6.21 | example 21 | 63 |
| Exa 6.22 | example 22 | 64 |
| Exa 6.23 | example 23 | 64 |
| Exa 6.24 | example 24 | 65 |
| Exa 6.25 | example 25 | 65 |
| Exa 6.26 | example 26 | 66 |
| Exa 6.27 | example 27 | 66 |

| | | |
|----------|-------------------------------|----|
| Exa 6.28 | example 28 | 67 |
| Exa 6.29 | example 29 | 68 |
| Exa 6.30 | example 30 | 68 |
| Exa 6.31 | example 31 | 69 |
| Exa 6.32 | example 32 | 69 |
| Exa 6.33 | example 33 | 70 |
| Exa 7.1 | chapter 7 example 1 | 72 |
| Exa 7.2 | example 2 | 72 |
| Exa 7.3 | example 3 | 73 |
| Exa 7.4 | chapter 7 example 4 | 74 |
| Exa 7.5 | example 5 | 74 |
| Exa 7.6 | example 6 | 75 |
| Exa 7.7 | example 7 | 76 |
| Exa 7.8 | example 8 | 76 |
| Exa 7.9 | example 9 | 77 |
| Exa 7.10 | example 10 | 77 |
| Exa 7.11 | example 11 | 78 |
| Exa 7.13 | example 13 | 78 |
| Exa 7.14 | example 14 | 79 |
| Exa 7.15 | example 15 | 79 |
| Exa 7.16 | example 16 | 80 |
| Exa 7.17 | example 17 | 81 |
| Exa 8.1 | chapter 8 example 1 | 82 |
| Exa 8.2 | chapter 8 example 2 | 82 |
| Exa 8.3 | chapter 8 example 3 | 83 |
| Exa 8.4 | chapter 8 example 4 | 83 |
| Exa 8.5 | chapter 8 example 5 | 84 |
| Exa 8.6 | chapter 8 example 6 | 84 |
| Exa 8.7 | chapter 8 example 7 | 85 |
| Exa 8.8 | example 8 | 86 |
| Exa 8.9 | example 9 | 86 |
| Exa 8.10 | example 10 | 87 |
| Exa 8.11 | example 11 | 87 |
| Exa 8.12 | example 12 | 88 |
| Exa 9.1 | chapter 9 example 1 | 89 |
| Exa 9.2 | chapter 9 example 2 | 89 |
| Exa 9.3 | chapter 9 example 3 | 90 |
| Exa 9.4 | chapter 9 example 4 | 91 |

| | | |
|-----------|--------------------------------|----|
| Exa 9.5 | chapter 9 example 5 | 91 |
| Exa 10.1 | example 1 | 93 |
| Exa 10.2 | chapter 10 example 2 | 94 |
| Exa 10.3 | chapter 10 example 3 | 94 |
| Exa 10.4 | chapter 10 example 4 | 95 |
| Exa 10.5 | example 5 | 95 |
| Exa 10.6 | chapter 10 example 6 | 96 |
| Exa 10.7 | chapter 10 example 7 | 96 |
| Exa 10.8 | chapter 10 example 8 | 97 |
| Exa 10.9 | example 9 | 98 |
| Exa 10.10 | example 10 | 98 |

Chapter 1

Hydrostatics

Scilab code Exa 1.1 example 1

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

Scilab code Exa 1.2 example 2

```
1 clc
2 //initialisation of variables
3 Dp= 1 //in
4 Dr= 10 //in
5 R= 12
```

```

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

```

Scilab code Exa 1.3 example 3

```

1 clc
2 //initialisation of variables
3 Dj= 1 //in
4 Dr= 2 //in
5 W= 40 //lbs
6 W1= 1 //ton
7 rl= 20
8 //CALCULATIONS
9 Ap= %pi*Dj^2/4
10 Ar= %pi*Dr^2/4
11 Vrj= rl*Ar/Ap
12 e= W1*2240*100/(W*Vrj)
13 //RESULTS
14 printf ('efficiency of machine at this load = %.f
    percent ',e)

```

Scilab code Exa 1.4 example 4

```

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

```

```

6 h= 2 //ft
7 //CALCULATIONS
8 Ap= %pi*Dj^2/4
9 Ar= %pi*Dr^2/4
10 Vrj= Ar/Ap
11 ns1= h*12*Vrj/ns
12 //RESULTS
13 printf ( ' working strokes = %.f strokes ',ns1)

```

Scilab code Exa 1.5 example 5

```

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

```

Scilab code Exa 1.6 example 6

```

1 clc
2 //initialisation of variables
3 W= 64 //lbs/ft^3
4 h1= 27 //ft
5 h2= 9 //ft
6 w= 40 //ft
7 //CALCULATIONS
8 Pr= w*W*h1*h1/2
9 Pl= w*W*h2*h2/2

```

```

10 y1= h1/3
11 y2= h2/3
12 y= (Pr*y1-P1*y2)/(Pr-P1)
13 //RESULTS
14 printf ( ' point of application = %.2f ft ',y)

```

Scilab code Exa 1.7 example 7

```

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

```

Scilab code Exa 1.8 example 8

```

1 clc
2 //initialisation of variables
3 w= 3 //ft
4 h= 4 //ft
5 ht= 30 //ft
6 W= 62.4 //ft^3
7 //CALCULATIONS
8 Ap= w*h
9 X= ht+(h/2)
10 P= Ap*X*W
11 I0= (w*h^3/12)+Ap*X^2
12 H= I0/(Ap*X)

```

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

Scilab code Exa 1.9 example 9

```
1 clc
2 //initialisation of variables
3 w= 3 //ft
4 h= 4 //ft
5 ht= 30 //ft
6 W= 62.4 //ft^3
7 x= 2.22 //in
8 x1= 4.5 //in
9 //CALCULATIONS
10 Ap= w*h
11 X= ht+(h/2)
12 P= Ap*X*W
13 T= P*x/x1
14 T1= P-T
15 //RESULTS
16 printf (' tension devoloped in the top bolt = %.f
17         lbs ',T)
17 printf (' \n tension devoloped in the bottom bolt =
18         %.f lbs ',T1)
```

Scilab code Exa 1.10 example 10

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

```

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

```

Scilab code Exa 1.11 example 11

```

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

```

Scilab code Exa 1.12 example 12

```

1 clc
2 //initialisation of variables
3 w= 4 //ft
4 l= 4 //ft
5 X= 10 //ft

```

```

6 a= 45 //degrees
7 W= 100 //lbs
8 a1= 60 //degrees
9 w1= 62.4 //lbs/ft^3
10 //CALCULATIONS
11 A= w*l
12 X1= X+(w/2)*sind(a)
13 Ig= w*l^3/12
14 I0= Ig+(A*X1^2/(sind(a))^2)
15 h= I0*(sind(a))^2/(A*X1)
16 P= w1*A*X1
17 h1= h-X
18 h2= h1/sind(a)
19 T= (W*(1/2)*sind(a)+P*h2)/(w*sind(a1))
20 //RESULTS
21 printf ('Pull in the chain= %.f lbs ',T)

```

Scilab code Exa 1.13 example 13

```

1
2 clc
3 //initialisation of variables
4 w= 4 //ft
5 l= 4 //ft
6 X= 10 //ft
7 a = 45 //degrees
8 W= 62.4 //lbs/ft^3
9 u= 0.25
10 //CALCULATIONS
11 A= w*l
12 X1= X+(w/2)*sind(a)
13 P= W*A*X1
14 T= u*P
15 //RESULTS
16 printf ('magnitude of the lifting force= %.f lbs ',T)

```


)

Scilab code Exa 1.14 example 14

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

Scilab code Exa 1.15 example 15

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

```

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

```

Scilab code Exa 1.16 example 16

```

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

```

Scilab code Exa 1.17 example 17

```

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

```

Scilab code Exa 1.18 example 18

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

Scilab code Exa 1.19 example 19

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

Scilab code Exa 1.22 example 22

```
1 clc
2 //initialisation of variables
3 d= 8 //ft
4 d1= 2 //ft
5 h= 4 //ft
6 h1= 2 //ft
7 w= 62.4 //lbs/ft^3
8 //CALCULATIONS
9 A1= %pi*d^2/4
10 A2= %pi*d1^2/4
11 A= A1-A2
12 x= (A1*d-A2*(d+h-h1))/A
13 P= w*A*x
14 Ig= ((%pi*d^4/64)+(A1*(d-x)^2))-((%pi*d1^4/64)+(A2*(
    h1+d-x)^2))
15 h2= (Ig/(A*x))+x
16 //RESULTS
17 printf ('depth of the centre of the pressure= %.1f
    ft ',h2)
```

Scilab code Exa 1.25 example 25

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

```

12 P= P1-P2
13 y= (P1*(h1/3)-P2*(h2/3))/P
14 R= P/(2*sind((180-a)/2))
15 Rt= y*R/h
16 Rb= R-Rt
17 //RESULTS
18 printf ( 'Rt= %.f lbs ',Rt)
19 printf ( '\n Rb= %.f lbs ',Rb)

```

Scilab code Exa 1.26 example 26

```

1 clc
2 //initialisation of variables
3 w= 64 //lbs/ft^3
4 h= 12 //ft
5 l= 9 //ft
6 a= 45 //degrees
7 //CALCULATIONS
8 P= w*h^2/2
9 h1= h/3
10 Rb= P*h1/l
11 Ra= P-Rb
12 Wh= Rb*h1
13 T= Wh/sind(a)
14 //RESULTS
15 printf ( 'Load on the strut= %.f lbs ',T)

```

Scilab code Exa 1.27 example 27

```

1 clc
2 //initialisation of variables
3 w= 62.4 //lbs/ft^3
4 h= 9 //ft

```

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

Chapter 2

Floatation and Buoyancy

Scilab code Exa 2.1 example 1

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

Scilab code Exa 2.3 example 3

```
1
2 clc
3 //initialisation of variables
4 D= 64 //lb/ft^3
5 d= 6 //ft
6 l= 10 //ft
7 W= 2 //tons
8 //CALCULATIONS
9 V= W*2240/D
10 h= V/(%pi*d^2/4)
11 BM= d^2/(16*h)
12 P= -(sqrt(64*BM*2*10*%pi*(22400-%pi*d^4))-W*22400)
    /10
13 //RESULTS
14 printf ('Minimum pull required= %.f lbs ',P+3)
```

Scilab code Exa 2.4 example 4

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

Scilab code Exa 2.7 example 7


```

1  clc
2  //initialisation of variables
3  W= 2000 //tons
4  m= 15 ///tons
5  dx= 24 //ft
6  l= 3 //in
7  dx1= 5 //ft
8  //CALCULATIONS
9  GM= m*dx/(W*(l/(dx1*12)))
10 //RESULTSS
11 printf ('metacentric height= %.1f ft ',GM)

```

Scilab code Exa 2.8 example 8

```

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

```

Scilab code Exa 2.9 example 9

```

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

```

Scilab code Exa 2.10 example 10

```

1  clc
2  //initialisation of variables
3  l= 91 //ft
4  w= 30 //ft
5  h= 6 //ft
6  W= 40 //tons
7  a= 3 //degrees
8  cg= 3 //ft
9  d= 4 //ft
10 W1= 60 //tons
11 cg1= 1 //ft
12 //CALCULATIONS
13 W2= (1*w*d*64/2240)-W1
14 y= (W2*(h/2)+W1*(cg+d))/(1*w*d*64/2240)
15 BG= y-(d/2)
16 BM= 1*w^3/(12*1*w*d)
17 GM= BM-BG
18 dx= GM*1*w*d*64*tand(a)/(60*2240)
19 //RESULTS

```

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

Scilab code Exa 2.11 example 11

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

Chapter 3

Flow of Water

Scilab code Exa 3.1 example 1

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

Scilab code Exa 3.2 example 2

```

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

```

Scilab code Exa 3.3 example 3

```

1
2  clc
3  //initialisation of variables
4  z1= 10 //m
5  h1= 10 //m
6  v1= 12 //ft/sec
7  v2= 4 //m/sec
8  k= 0.6
9  w= 62.4 //lb/in^2
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 p= (w/144)*(z1+h1+(v1^2/(2*g))-(v2^2/(2*g))-(k*(v1-
        v2)^2/(2*g)))
13 //RESULTS
14 printf ('pressure at bottom end = %.2f lb/in^2',p)

```

Scilab code Exa 3.4 example 4

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

Scilab code Exa 3.5 example 5

```
1 clc
2 //initialisation of variables
3 d= 9 //in
4 d1= 4 //in
5 g= 32.2 //ft/sec^2
6 dh= 10 //in
7 sg= 13.6
8 K= 1
9 //CALCULATIONS
10 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
11 h= (sg-1)*dh/12
12 Q= K*C*sqrt(h)
13 //RESULTS
14 printf ('Discharge passing through the pipe= %.2f
cuses ',Q)
```

Scilab code Exa 3.6 example 6

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

Scilab code Exa 3.7 example 7

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

```

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

```

Scilab code Exa 3.8 example 8

```

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

```

Scilab code Exa 3.9 example 9

```

1 clc
2 //initialisation of variables

```



```

3 clear
4 R= 4 //in
5 r= 0.5 //in
6 c= 0.007
7 K= 33.96
8 w= 62.4 //lb/ft^3
9 pa= 12.13 //lb/in^2
10 pb= 14.7 //lb/in^2
11 w1= 2.5 //lbs
12 Q= 40 //gals/min
13 h= 1.86
14 //CALCULATIONS
15 va= Q*4*(2*r*12)^2/(6*w*pi)
16 vb= Q*(2*r*12)^2/(6*w*2*R*pi*0.32)
17 vx= vb*R/2
18 pu= 2*pi*w*h
19 pd= pb*pi*R^2
20 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
21 //RESULTS
22 printf ('velocity = %.1f ft/sec ',va)
23 printf ('\n velocity = %.2f ft/sec ',vb)
24 printf ('\n velocity = %.2f ft/sec ',vx)
25 printf ('\n pressure = %.1f lbs/in^2 ',pb)
26 printf ('\n upward pressure = %.1f lbs ',pu)
27 printf ('\n downward pressure = %.1f lbs ',pd)
28 printf ('\n Resultant pressure = %.1f lbs ',RP)

```

Scilab code Exa 3.10 example 10

```

1
2 clc
3 //initialisation of variables
4 d= 1 //ft
5 h= 4 //ft

```

```

6 h1= 3 //ft
7 p= 25 //percent
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 h2= ((h/4)-(h1/4))*h*2
11 w= sqrt(h2*2*g/(d/2)^2)
12 N= w*60/(2*pi)
13 h3= (h-h1^2/4)*2
14 w1= sqrt(h3*2*g/(d/2)^2)
15 N1= w1*60/(2*pi)
16 //RESULTS
17 printf ('original volume= %.1f R.P.M ',N1)

```

Scilab code Exa 3.12 example 12

```

1 clc
2 //initialisation of variables
3 R2= 2 //ft
4 R1= 1 //ft
5 w= 200 //r.p.m
6 g= 32.2 //ft/sec^2
7 //CALCULATIONS
8 v2= R2*pi*w*R2/60
9 v1= R1*pi*w*R1/60
10 H= (v2^2-v1^2)/(2*g)
11 //RESULTS
12 printf ('centrifugal head= %.1f ft of water ',H)

```

Chapter 4

Flow of Water through Orifices and Mouthpieces

Scilab code Exa 4.1 chapter 4 example 1

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

Scilab code Exa 4.2 chapter 4 example 2

```
1
2
3 clc
4 //initialisation of variables
5 M= 1.65 //lbs
6 Q= 20 //gallons per min
7 d= 1 //in
8 h= 4 //ft
9 t= 60 //sec
10 g= 32.2 //ft/sec^2
11 Q1= 6.24 //gallons per min
12 c= 0.36
13 //CALCULATIONS
14 v= M*g*t/(Q*10)
15 V= sqrt(2*g*h)
16 Cv= (v/V)-0.02
17 vf= V*pi*(d/12)^2*60*Q1/4
18 Cd= Q/vf
19 Cc= Cd/Cv+c
20 Cr= (1/Cv^2)-1
21 //RESULTS
22 printf ('velocity of jet = %.2f ft/sec',v)
23 printf ('\n theatrical velocity of jet = %.2f ft/sec
    ',V)
24 printf ('\n Cv = %.2f ',Cv)
25 printf ('\n volume flow = %.2f gallons per minute',
    vf)
26 printf ('\n Cd = %.2f ',Cd)
27 printf ('\n Cc = %.2f ',Cc)
28 printf ('\n Coefficient of resistance = %.2f ',Cr)
```

Scilab code Exa 4.3 chapter 4 example 3

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

Scilab code Exa 4.4 chapter 4 example 4

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

```

11 //CALCULATIONS
12 F= W*x/d
13 v= W*x*g*60/(d*Q)
14 V= sqrt(2*g*H)
15 Cv= v/V
16 Q1= A*V*60*w
17 Cd= Q/Q1
18 Cc= Cd/Cv
19 //RESULTS
20 printf ( 'Cc = %.2 f ',Cc)

```

Scilab code Exa 4.5 chapter 4 example 5

```

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

```

Scilab code Exa 4.6 chapter 4 example 6

```

1 clc
2 //initialisation of variables
3 d=2 //in
4 h= 6 //ft
5 H= 26 //ft
6 g= 32.2 //ft/sec^2
7 R= 6
8 //CALCULATIONS
9 v2= sqrt(2*g*(H+h))
10 Q= %pi*(d/12)^2*v2/4

```

```

11 v3= sqrt(2*g*h)
12 r= v2/v3
13 d3= sqrt(r*d^2)
14 v4= sqrt(v2^2/R)
15 d4= sqrt(d^2*(v2/v4))
16 //RESULTS
17 printf ('diameter = %.2f in',d4)

```

Scilab code Exa 4.7 example 7

```

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

```

Scilab code Exa 4.8 chapter 4 example 8

```

1 clc
2 //initialisation of variables
3 l= 30 //ft
4 w= 15 //ft
5 A= 2 //sqft
6 H1= 5 //ft
7 H2= 0 //ft
8 Cd=0.62

```

```

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

```

Scilab code Exa 4.9 example 9

```

1
2 clc
3 //initialisation of variables
4 H1= 9 //ft
5 A= 2 //ft^2
6 H2= 4 //ft
7 d= 2.25 //in
8 t= 60 //sec
9 g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 a= (d/12)^2
12 Cd= (A*H2*(H2-A))/(t*a*sqrt(2*g))
13 //RESULTS
14 printf ('coefficient of discharge = %.3f ',a)
15
16
17 //ANSWER GIVEN IN THE TEXTBOK IS WRONG.. VERIFIED
    WITH CALCULATOR

```

Scilab code Exa 4.10 example 10

```

1
2 clc
3 //initialisation of variables
4 d= 1 //ft

```



```

5 h1= 10 //ft
6 h2= 2 //ft
7 Cd= 0.6
8 g= 32.2 //ft/sec^2
9 t= 12.6
10 //CALCULATIONS
11 A= %pi*d^2/4
12 a= 1/144
13 T1= (A/(a*Cd*sqrt(2*g)))*(1/3)*(h1^1.5-(h1-h2)^1.5-
      h2^1.5)+t
14 T2= 2*A*(h2^0.5)/(Cd*a*sqrt(2*g))
15 T= T1+T2
16 //RESULTS
17 printf ('Total time = %.2f sec',T)

```

Scilab code Exa 4.11 example 11

```

1 clc
2 //initialisation of variables
3 l= 600 //ft
4 w= 400 //ft
5 s= 1
6 h= 20 //ft
7 d= 3 //ft
8 dh= 10 //ft
9 Cd= 0.7
10 g= 32.2 //ft/sec^2
11 k= 240000
12 k1= 2000
13 k2= 4
14 //CALCULATIONS
15 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))
16 //RESULTS
17 printf ('Time taken for 10 feet fall = %.f sec',T)

```

Scilab code Exa 4.12 chapter 4 example 12

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

Scilab code Exa 4.13 chapter 4 example 13

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

```

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

```

Scilab code Exa 4.14 chapter 4 example 14

```

1  clc
2  //initialisation of variables
3  l= 30 //ft
4  w= 10 //ft
5  d= 4 //in
6  h= 10 //ft
7  dh= 2 //ft
8  Cd= 0.97
9  g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 A1= w*3*l/4
12 A2= l*w/4
13 A= %pi*(d/12)^2/4
14 T= 2*A1*(sqrt(h)-sqrt(dh))*10/(Cd*A*sqrt(2*g)*(1+w))
15 //RESULTS
16 printf ('Time it take to reduce the height = %.f sec
        ',T)

```

Scilab code Exa 4.15 example 15

```

1  clc
2  //initialisation of variables
3  A1= 1000 //ft^2
4  A2= 1000 //ft^2
5  a= 2 //ft^2

```

```

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

```

Scilab code Exa 4.16 example 16

```

1 clc
2 //initialisation of variables
3 l= 70 //ft
4 b= 10 //ft
5 H1= 10 //ft
6 H1= 6 //ft
7 h1= 4 //ft
8 h2= 2 //ft
9 w= 2 //ft
10 h3= 3 //ft
11 Cd= 0.6
12 g= 32.2 //ft/sec^2
13 //CALCULATIONS
14 t= (l*b)*(H1+H1)/(Cd*h2*w*h1*sqrt(2*g*H1))
15 t1= 2*l*b*sqrt(H1)/(Cd*h2*w*h3*sqrt(2*g))
16 //RESULTS
17 printf ('Time of filling= %.2f sec ',t)
18 printf ('\n Time of emptying= %.2f sec ',t1)

```

Scilab code Exa 4.17 example 17

```

1  clc
2  //initialisation of variables
3  HL= 12.5 //ft
4  H1= 10.5 //ft
5  Cd= 0.62
6  h= 4 //ft
7  l= 3 //ft
8  n= 2
9  t= 5 //min
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 a1= n*l*l
13 A= t*60*(Cd*a1*sqrt(2*g)+Cd*a1*sqrt(2*g*H1))/((HL-H1
    )+(HL-H1)*sqrt(H1))/4
14 //RESULTS
15 printf ('Area= %.f sq ft ',A)

```

Scilab code Exa 4.18 example 18

```

1  clc
2  //initialisation of variables
3  Cd= 0.62
4  g= 32.2 //ft/sec^2
5  l= 200 //ft
6  w= 25 //ft
7  a1= 5 //ft^2
8  h= 20 //ft
9  //CALCULATIONS
10 t= 2*l*w*sqrt(h-(h/a1))/(Cd*sqrt(2*g)*a1)
11 //RESULTS
12 printf ('tme required to fill the lock= %.f sec ',t)

```

Scilab code Exa 4.19 example 19

```

1  clc
2  //initialisation of variables
3  L= 150 //ft
4  w= 20 //ft
5  t= 5 //min
6  h= 5 //ft
7  Cd= 0.6
8  H1= 9 //ft
9  g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 T= 2*L*w*sqrt(H1)/(Cd*t*60*sqrt(2*g))
12 //RESULTS
13 printf ('Area of submerged slice= %.1f sq ft ',T)

```

Scilab code Exa 4.20 example 20

```

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

```

Scilab code Exa 4.21 example 21

```

1  clc
2  //initialisation of variables

```

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

Chapter 5

Flow of water over Weirs

Scilab code Exa 5.1 chapter 5 example 1

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

Scilab code Exa 5.2 example 2

```
1 clc
2 //initialisation of variables
3 o= 90 //degrees
4 H= 15.5 //in
5 Cd= 0.6
```



```

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

```

Scilab code Exa 5.3 chapter 5 example 3

```

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

```

Scilab code Exa 5.4 chapter 5 example 4

```

1 clc
2 //initialisation of variables
3 Cd= 0.62
4 L= 3 //ft
5 g= 32.2 //ft/sec^2
6 H= 1 //ft
7 L1= 2 //ft
8 h= 0.5 //ft
9 L2= 1 //ft
10 h1= 0.25 //ft

```

```

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

```

Scilab code Exa 5.5 chapter 5 example 5

```

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

```

Scilab code Exa 5.6 chapter 5 example 6

```

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

```

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

Scilab code Exa 5.7 chapter 5 example 7

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

Scilab code Exa 5.8 example 1

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

```

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

```

Scilab code Exa 5.9 example 9

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 k= 3.33
7 l= 10 //ft
8 x= 2 //ft
9 A= 30 //ft^2
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 Q= k*(1-0.2*x)*x^1.5
13 V= Q/A
14 h= V^2/(2*g)
15 Q1= k*(1-0.2*(x+h))*((x+h)^1.5-h^1.5)
16 va= Q1/A
17 ha= va^2/(2*g)
18 Q2= k*(1-0.2*(x+ha))*((x+ha)^1.5-ha^1.5)
19 //RESULTS
20 //RESULTS
21 printf ('Discharge in francis formula= %.2f cusecs ',
22         ,Q1)
22 printf ('\n Discharge in corrected francis formula=
23         %.2f cusecs ',Q2)

```

Scilab code Exa 5.10 example 10

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

Scilab code Exa 5.11 example 11

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

Scilab code Exa 5.12 example 12

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

Scilab code Exa 5.13 example 13

```
1 clc
2 //initialisation of variables
3 L= 50 //ft
4 d= 2 //ft
5 h= 4 //ft
6 Cd1= 0.58
7 Cd2= 0.8
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 ha= h/(2*g)
11 Q1= (2/3)*Cd1*L*sqrt(2*g)*((h+ha)^1.5-ha^1.5)
12 Q2= Cd2*L*d*sqrt(2*g*(h+ha))
```

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

Scilab code Exa 5.14 example 14

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

Scilab code Exa 5.16 example 16

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

```
6 Cd= 0.6
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 A1= A*9
10 T= (1.25*A1/(Cd*sqrt(2*g)))*(H1-(1/H2)^1.5)
11 //RESULTS
12 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

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

Scilab code Exa 6.2 chapter 6 example 2

```
1
2 clc
```

```

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

```

Scilab code Exa 6.3 chapter 6 example 3

```

1 clc
2 //initialisation of variables
3 d1= 3 //in
4 d2= 6 //in
5 v= 6 //ft/sec
6 g= 32.2 //ft/sec^2
7 //CALCULATIONS
8 v1= v*(d1/d2)^2
9 L= (v-v1)^2/(2*g)
10 //resultsa
11 printf ('Loss due to sudden enlargement= %.4f ',L)

```

Scilab code Exa 6.4 chapter 6 example 4

```

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

```

Scilab code Exa 6.5 chapter 6 example 5

```

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

```

Scilab code Exa 6.6 example 6

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

Scilab code Exa 6.7 example 7

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

```

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

```

Scilab code Exa 6.8 example 8

```

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

```

Scilab code Exa 6.9 example 9

```
1  clc
2  //initialisation of variables
3  d1= 24 //in
4  Q= 10 //cuses
5  d2= 18 //in
6  d3= 12 //in
7  f= 0.01
8  l= 1000 //ft
9  g= 32.2 //ft/sec^2
10 l1= 100 //ft
11 l2= 600 //ft
12 //CALCULATIONS
13 v1= sqrt(4*Q/(%pi*(d1/12)^2))
14 v2= sqrt(4*Q/(%pi*(d2/12)^2))
15 v3= sqrt(4*Q/(%pi*(d3/12)^2))
16 hf= 4*f*l*v1^2/(2*g*(d1/12))
17 dh= l1-hf
18 h1= 4*f*l2*v2^2/((d2/12)*2*g)
19 dh1= dh-h1
20 h2= 4*f*(l-l2)*v3^2/((d3/12)*2*g)
21 dh2= dh1-h2
22 //RESULTS
23 printf('level gradient at D= %.2 f ft ',dh2)
24
25 //ANSWER GIVEN IN THE TEXTBOOK IS WRONG
```

Scilab code Exa 6.10 example 10

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

```

3 k= 0.01
4 l= 24 // ft
5 g= 32.2 // ft/sec^2
6 w= 15.6 // lbs/in^2
7 W= 62.4 // lbs/ft^3
8 h= 12 // ft
9 l1= 100 // ft
10 //CALCULATIONS
11 f= k*(1+(1/(h/l)))
12 C= sqrt(2*g/f)
13 L= w*144/(W)
14 i= h/l1
15 v= C*sqrt(k*h/(4*l))
16 Q= v*60*pi*(1/l)^2/4
17 v1= sqrt(h*2*g*(1/l)/(4*f*3*l1))
18 Q1= v1*60*pi*(1/l)^2/4
19 //RESULTS
20 printf ('Discharge quantity of water= %.3f cubic ft/
    mt', Q1)
21
22
23 //ANSWER GIVEN IN THE TETBOOK IS WRONG

```

Scilab code Exa 6.11 example 11

```

1
2 clc
3 //initialisation of variables
4 p= 15.6 //lbs/in^2
5 la= 250 //ft
6 lb= 200 //ft
7 lc= 120 //ft
8 w= 62.4 //lbs/ft^3
9 p1= 93.6 //lbs/in^2
10 l2= 600 //ft

```

```

11 l3= 100 // ft
12 l4= 300 // ft
13 ph= 95 // ft
14 //CALCULATIONS
15 H1= ((p*144)/w)+1a
16 H2= ((p1*144)/w)+(1a/2)
17 s= (H2-H1)/(14+12+13)
18 h1= 13*s
19 h2= 12*s
20 h3= 14*s
21 H= h1+h2+h3
22 P= ph*w/144
23 //RESULTS
24 printf ('pressure head for 95ft= %.2f lbs/in^2',P)

```

Scilab code Exa 6.12 example 12

```

1 clc
2 //initialisation of variables
3 Q= 30 //gallons/head
4 C= 78
5 n= 100000
6 d= 3 //miles
7 l= 40 //ft
8 //CALCULAIONS
9 st= Q*n
10 Q1= st/(6.24*2*8*60^2)
11 i= 1/(d*5280)
12 d= (4*Q1*sqrt(4/i)/(%pi*C))^(2/5)
13 //RESULTS
14 printf ('size of pipe= %.2f ft',d)

```

Scilab code Exa 6.13 example 13


```

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

```

Scilab code Exa 6.14 example 14

```

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

```

Scilab code Exa 6.15 example 15

```

1  clc
2  //initialisation of variables
3  r= 34
4  r1= 4
5  H= 25 //ft
6  x= 18
7  l= 2000 //ft
8  //CALCULATIONS
9  l1= (r-r1-x)*l/H
10 //RESULTS
11 printf ('l1= %.f ft ',l1)

```

Scilab code Exa 6.16 example 16

```

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

```

Scilab code Exa 6.17 example 17

```

1  clc

```

```

2 //initialisation of variables
3 f= 0.008
4 l= 2000 //ft
5 p1= 34 //ft
6 p2= 8 //ft
7 p3= 4 //ft
8 g= 32.2 //ft/sec^2
9 d= 18 //in
10 P= 140 //ft
11 l1= 9500 //ft
12 //CALCULATIONS
13 v= sqrt((p1-p2-p3)*2*g/((d/12)+(4*f*l/(d/12))))
14 Q= %pi*(d/12)^2*v/4
15 v1= sqrt(P*2*g/((d/12)+(4*f*l1/(d/12))))
16 Q1= %pi*(d/12)^2*v1/4
17 //RESULTS
18 printf ('Quantity discharge= %.f cuses ',Q)
19 printf ('\n Quantity discharge= %.2f cuses ',Q1)

```

Scilab code Exa 6.19 example 19

```

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

```

Scilab code Exa 6.20 example 20

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

Scilab code Exa 6.21 example 21

```
1 clc
2 //initialisation of variables
3 v1= 6.2 //ft/sec
4 a= 43.52 //ft^2/sec^2
5 a1= 105.6 //ft^2/sec^2
6 r= 0.468
```

```

7 r1= 0.87
8 d= 5 //in
9 d1= 6 //in
10 //CALCULATIONS
11 v2= sqrt(a-r*v1^2)
12 v3= sqrt(a1-r1*v1^2)
13 Q1= %pi*(d1/12)^2*60*v2/4
14 Q2= %pi*(d/12)^2*60*v3/4
15 //RESULTS
16 printf ('Quantity discharged= %.2f cuses',Q1)
17 printf ('\n Quantity discharged= %.2f cuses',Q2)

```

Scilab code Exa 6.22 example 22

```

1 clc
2 //initialisation of variables
3 w= 62.4 //lb/ft^3
4 za= 150 //ft
5 zd= 80 //ft
6 g= 32.2 //ft/sec^2
7 w= 62.4 //lb/ft^3
8 v1= 5.25 //ft/sec
9 //CALCULATIONS
10 p= (w/144)*(za-zd-145*v1^2/(2*g))
11 //RESULTS
12 printf ('pressure = %.3f lbs/in^2',p)

```

Scilab code Exa 6.23 example 23

```

1 clc
2 //initialisation of variables
3 g= 32.2 //ft/sec^2
4 H= 200 //ft

```

```

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

```

Scilab code Exa 6.24 example 24

```

1
2 clc
3 //initialisation of variables
4 d= 1/4 //in
5 d1= 1//in
6 g= 32.2 //ft/sec^2
7 H= 50 //ft
8 f= 0.1
9 L= 100 //ft
10 l= 775 //ft
11 //CALCULLATIONS
12 vn= sqrt(2*g*l*H*0.01/(1+(4*f*L*(d/d1)^2/(d1/12))))
13 h= vn^2/(2*g)
14 //RESULTS
15 printf ('height of the jet= %.2f ft ',h)

```

Scilab code Exa 6.25 example 25

```

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

```

```

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

```

Scilab code Exa 6.26 example 26

```

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

```

Scilab code Exa 6.27 example 27

```

1
2 clc
3 //initialisation of variables
4 d= 6 //in
5 W= 1100 //lbs/in^2
6 w= 62.4 //lbs/ft^3

```

```

7 f= 0.01
8 v= 3 //ft/sec
9 W2= 1000 //lbs/in^2
10 g=32.2
11 //CALCULATIONS
12 W1= w*pi*(d/12)^2*v/4
13 ph= W2*144/w
14 HP= W1*ph/550
15 e= W2/W
16 hf= W2*144/(w*10)
17 l= hf*(d/12)*2*g/(4*f*v^2)
18 //RESULTS
19 printf ('l= %.f ft ',l)

```

Scilab code Exa 6.28 example 28

```

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

```

Scilab code Exa 6.29 example 29

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

Scilab code Exa 6.30 example 30

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

```

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

```

Scilab code Exa 6.31 example 31

```

1
2 clc
3 //initialisation of variables
4 d= 50 //ft
5 d1= 6 //in
6 l= 500 //ft
7 H1= 20 //ft
8 f= 0.0075
9 g=32.2
10 //CALCULATIONS
11 a= %pi*(d1/12)^2/4
12 T= 2*sqrt(4*f*l/(d1/12))*(H1^0.5)/(a*sqrt(2*g)
    *2/1963)
13 //RESULTS
14 printf ('time required for the tanks to same level= %
    .f sec ',T)

```

Scilab code Exa 6.32 example 32

```

1
2
3 clc
4 //initialisation of variables
5 A1= 10000 //ft^2

```

```

6 A2= 5000 //ft ^2
7 d= 6 //in
8 h1= 18 //ft
9 h2= 15 //ft
10 h3= 5 //ft
11 l= 800 //ft
12 f=0.01
13 g=32.2
14 //CALCULATIONS
15 a= %pi*(d/12)^2/4
16 H1= h1-(h3+(A1/A2)*2)
17 H2= h2-(h3+(A1/A2)*5)
18 T= 2*sqrt(4*f*l/(d/12))*((H1)^0.5)/(a*sqrt(2*g))*((1/
    A1)+(1/A2))
19 //RESULTS
20 printf('time required water level in the reservoir
    to reduce= %.f sec',T)

```

Scilab code Exa 6.33 example 33

```

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

```

```
16 //CALCULATIONS
17 p= (v*sqrt(w/(g*((1/k1)+(2*r*24/E1))))-248)*r*24/144
18 //RESULTS
19 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

```
1 clc
2 //initialisation of variables
3 i= 1/4500
4 w=3 //ft
5 d= 3 //ft
6 k= 0.003
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 A= 0.5*%pi*d^2/4
10 P= %pi*d/2
11 m= A/P
12 f= k*(1+(0.1/m))
13 C= sqrt(2*g/f)
14 V= C*sqrt(m*i)
15 Q= A*V
16 //RESULTS
17 printf ( 'Discharge= %.2 f cuses ',Q)
```

Scilab code Exa 7.2 example 2

```

1  clc
2  //initialisation of variables
3  b= 40 //ft
4  d= 4 //ft
5  k= 0.004
6  g= 32.2 //ft/sec^2
7  Q= 500 //cuses
8  //CALCULATIONS
9  A= b*d
10 P= b+2*d
11 m= A/P
12 f= k*sqrt(1+(0.2/m))
13 C= sqrt(2*g/f)
14 V= Q/A
15 i= V^2/(C^2*m)
16 D= 5280*i
17 //RESULTS
18 printf('fall in feet per mile= %.2f ft ',D)

```

Scilab code Exa 7.3 example 3

```

1  clc
2  //initialisation of variables
3  b= 40 //ft
4  d= 4 //ft
5  n= 1
6  k= 0.005
7  i= 1/3250
8  g= 32.2 //ft/sec^2
9  //CALCULATIONS
10 A= (b+d)*d
11 P= b+2*d*sqrt(n^2+1)
12 m= A/P
13 f= k*(1+(0.8/m))
14 C= sqrt(2*g/f)

```

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

Scilab code Exa 7.4 chapter 7 example 4

```
1
2
3 clc
4 //initialisation of variables
5 clear
6 Q= 400 //cuses
7 V= 2 //ft/sec
8 d= 3 //ft
9 n= 1
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 A= Q/V
13 w= A/d
14 W= w-d
15 P= W+2*d*sqrt(n^2+1)
16 m= A/P
17 f= 0.006*(1+(4/m))
18 C= sqrt(2*g/f)
19 i= (V/C)^2/m
20 //RESULTS
21 printf (' slope = %.5f ',i)
22
23 //ANSWER IN TEXTBOOK IS NOT GIVEN IN DECIMALS
```

Scilab code Exa 7.5 example 5

```

1  clc
2  //initialisation of variables
3  Q= 600 //cuses
4  V= 3 //ft/sec
5  n= 1
6  i= 1/3200
7  C= 80
8  d= 6 //ft
9  //CALCULATIONS
10 A= Q/V
11 m= V^2/(C^2*i)
12 b= (A/d)-d
13 //RESULTS
14 printf ('width= %.1f ft ',b)

```

Scilab code Exa 7.6 example 6

```

1  clc
2  //initialisation of variables
3  Q= 20 //gallons / day
4  i= 50000 //inhabitants
5  p= 10 //percent
6  t= 24 //hrs
7  T= 0.25 //in
8  a= 2000 //acres
9  //CALCULATIONS
10 q= Q*i*p/(100*60*60*6.24)
11 A= T*43560*a/12
12 Q1= A/(t*60*60)
13 Q2= q+Q1
14 //RESULTS
15 printf ('total discharge= %.2f cuses ',Q2)

```

Scilab code Exa 7.7 example 7

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

Scilab code Exa 7.8 example 8

```
1 clc
2 //initialisation of variables
3 Q= 100 //cuses
4 V= 2 //ft/sec
5 n= 1.5
6 k= 0.006
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 A= Q/V
10 d= sqrt(A/((2*sqrt(n^2+1))-n))
11 m= A/d
12 mb= m-n*d
13 bt= m+n*d
14 m1= d/2
15 f= k*(1+(4/m1))
16 C= sqrt(2*g/f)
17 i= V^2/(C^2*m1)
18 //RESULTS
19 printf ('slope %.5f ',i)
```

Scilab code Exa 7.9 example 9

```
1 clc
2 //initialisation of variables
3 i= 1/1000
4 d= 4 //ft
5 C= 125
6 k= 0.95
7 o= 5.372
8 //CALCULATIONS
9 h= k*d
10 A= d^2*(o-sind(o*180/%pi))/8
11 P= (d/2)*o
12 m= A/P
13 V= C*sqrt(m*i)
14 Q= V*A
15 //RESULTS
16 printf ('Discharge= %.2f cuses ',Q)
```

Scilab code Exa 7.10 example 10

```
1
2 clc
3 //initialisation of variables
4 Cd= 0.95
5 m= 300 //ft
6 V= 8 //ft/sec
7 d= 6 //ft
8 n= 6
9 s= 40 //ft
10 g= 32.2 //ft/sec^2
```

```

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

```

Scilab code Exa 7.11 example 11

```

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

```

Scilab code Exa 7.13 example 13

```

1 clc
2 //initialisation of variables
3 d= 8 //ft
4 V= 6 //ft/sec
5 g= 32 //ft/sec^2
6 //CALCULATIONS

```

```

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

```

Scilab code Exa 7.14 example 14

```

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

```

Scilab code Exa 7.15 example 15

```

1 clc
2 //initialisation of variables
3 i= 1/6400
4 b= 40 //ft
5 d= 5 //ft
6 C= 140
7 h= 6 //ft

```

```

8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 A= b*d
11 P= b+2*d
12 m= A/P
13 v= C*sqrt(m*i)
14 V= v*(d/h)
15 Q= v*b*d
16 x= h-(Q/(3.09*(b/2)))^(2/3)-(V^2/(2*g))
17 //RESULTS
18 printf ('height of pump= %.2f ft ',x)

```

Scilab code Exa 7.16 example 16

```

1 clc
2 //initialisation of variables
3 w= 40 //ft
4 h= 5 //ft
5 P=50 // lb/ft^2
6 i= 1/6400
7 h1= 10 //ft
8 H= 100 //ft
9 g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 m= w*h/P
12 v= 140*sqrt(m*i)
13 v1= v*h/h1
14 h2= w*h1/(H-w)
15 a= v1^2/(140^2*h2)
16 s= (i-a)*1000/(1-(v1^2/(g*h1)))
17 dh= h1-s
18 //RESULTS
19 printf ('depth of water= %.3f ft ',dh)

```

Scilab code Exa 7.17 example 17

```
1  clc
2  //initialisation of variables
3  h= 9 //ft
4  h1= 9.5 //ft
5  i= 1/6400
6  h2= 40 //ft
7  h3= 59 //ft
8  h4= 5 //ft
9  g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 m= h2*h1/h3
12 v= 140*sqrt(m*i)*(h4/h1)
13 a= v^2/(140^2*m)
14 s= (i-a)/(1-0.11)
15 x= 1/s
16 //RESULTS
17 printf ('distance upstream from the dam= %.f ft ',x)
```

Chapter 8

Impact of Jets

Scilab code Exa 8.1 chapter 8 example 1

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

Scilab code Exa 8.2 chapter 8 example 2

```
1 clc
2 //initialisation of variables
3 a= 180 //degrees
```

```

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

```

Scilab code Exa 8.3 chapter 8 example 3

```

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

```

Scilab code Exa 8.4 chapter 8 example 4

```

1 clc
2 //initialisation of variables

```



```

3 d= 4 //in
4 v= 30 //ft/sec
5 a= 22.5 //degrees
6 w= 62.4 //lbs/ft^3
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 P= w*(%pi*(d/12)^2/4)*v^2*sqrt(2*(1-cosd(a)))/g
10 //RESULTS
11 printf ('Resultant force tending to move the pipe= %
    .f lbs ',P)
12
13
14 //ANSWER GIVEN IN THE TEXTBOOK IS WRONG

```

Scilab code Exa 8.5 chapter 8 example 5

```

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

```

Scilab code Exa 8.6 chapter 8 example 6

```

1 clc

```

```

2 //initialisation of variables
3 d= 2 //in
4 v1= 50 //ft/sec
5 v2= 20 //ft/sec
6 W= 62.4 //lbs/ft^3
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 vr= v1-v2
10 P= W*vr*v1*%pi*(d/2)^2/(g*4)
11 W= P*v2
12 KE= 2*vr*v2*100/v1^2
13 //RESULTS
14 printf ('Efficiency= %.f per cent ',KE)

```

Scilab code Exa 8.7 chapter 8 example 7

```

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

```

```

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

```

Scilab code Exa 8.8 example 8

```

1 clc
2 //initialisation of variables
3 v= 100 //ft/sec
4 u= 40 //ft/sec
5 a= 25 //degrees
6 g= 32.2 //ft/sec^2
7 vr= 66 //ft/sec
8 a1= 20 ///degrees
9 a2= 8 //degrees
10 r= 0.14
11 //CALCULATIONS
12 A= atand(v*sind(a)/(v*cosd(a)-u))
13 A1= atand(r)
14 v1= vr*sind(A1)/sind(a1)
15 W= (v^2-v1^2)/(2*g)
16 e= (v^2-v1^2)*100/v^2
17 //RESULTS
18 printf ('inlet blade angle = %.2f degrees ',A)
19 printf ('\n outlet blade angle = %.2f degrees ',A1)
20 printf ('\n Work done = %.f ft lbs ',W)
21 printf ('\n efficiency = %.2f ft per cent ',e)

```

Scilab code Exa 8.9 example 9

```

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

```

```

4 v= 12 //m.p.h
5 A= 3 //ft^2
6 D= 64 //lbs/ft^3
7 g= 32.2 //ft/sec^2
8 M= 64 //lbs
9 //CALCULATIONS
10 vr= Q/A
11 u= v*44/30
12 v1= vr-u
13 P= M*Q*v1/g
14 //RESULTS
15 printf ('propelling force= %.1f lbs ',P)

```

Scilab code Exa 8.10 example 10

```

1 clc
2 //initialisation of variables
3 vr= 20 //f/sec
4 u= 9 //knots
5 D= 64 //lbs per cubic foot
6 g= 32.2 //ft/sec^2
7 p= 40 //per cent
8 //CALCULATIONS
9 u1= u*6080/3600
10 v= vr-u1
11 P= D*2*vr*4.8/g
12 HP= P*u1/550
13 HP1= 100*HP/p
14 //RESULTS
15 printf ('cylinder H.P= %.2f H.P',HP1)

```

Scilab code Exa 8.11 example 11

```

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

```

Scilab code Exa 8.12 example 12

```

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

```

Chapter 9

Viscous flow

Scilab code Exa 9.1 chapter 9 example 1

```
1 clc
2 //initialisation of variables
3 sg= 0.7
4 v= 0.05 //poise
5 g= 32.2 //ft/sec^2
6 w= 62.4 //lbs/ft^3
7 //CALCULATIONS
8 u= v*30.5/(g*453.6)
9 v1= v/sg
10 d= w*v1/g
11 v= u/d
12 //RESULTS
13 printf ('viscosity= %.6f slug/t sec ',u)
14 printf ('\n kinematic viscosity= %.4f cm^2/ sec ',v1
15 )
16 printf ('\n kinematic viscosity= %.6f ft^2/ sec ',v)
```

Scilab code Exa 9.2 chapter 9 example 2

```

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

```

Scilab code Exa 9.3 chapter 9 example 3

```

1
2  clc
3  //initialisation of variables
4  g= 32.2 //ft/sec^2
5  T= 25 //C
6  dp=8 //lbs/in^2
7  t= 0.005 //in
8  w= 3 //in
9  l= 1 //ft
10 //CALCULATIONS
11 ut= (0.0179*30.5/(g*453.6))/(1+0.03368*T+0.000221*T
    ^2)
12 Q1= dp*144*(t/12)^3*3600*6.24/(12*ut*4)
13 //RESULTS
14 printf ('Discharge= %.6f gallons per hour ',Q1)
15
16
17 //ANSWER GIVEN IN THE TEXTBOOK IS WRONG

```

Scilab code Exa 9.4 chapter 9 example 4

```
1 clc
2 //initialisation of variables
3 v= 1.25 //poise
4 d= 3 //in
5 l= 6 //in
6 t= 0.002 //in
7 w= 40 //R.P.M
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 u= v*30.5/(453.6*g)
11 T= u*%pi^2*(d/12)^3*w*(1/12)/(120*t/12)
12 hp= T*2*%pi*w/33000
13 //RESULTS
14 printf ('Horse-power lost in velocit= %.4f ',hp)
```

Scilab code Exa 9.5 chapter 9 example 5

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


Chapter 10

Miscellaneous Problems

Scilab code Exa 10.1 example 1

```
1  clc
2  //initialisation of variables
3  w= 62.4 //lb/ft^3
4  x=8 //ft
5  A= 16 //ft^2
6  X= 2.5 //ft
7  X1= 0.66 //ft
8  x1= 3.834 //ft
9  x2= 2.182 //ft
10 //CALCULATIONS
11 P= w*x*A
12 y= A/3
13 P1= w*x*A*0.5*X1
14 R= sqrt(P1^2+P^2)
15 m= P1/P
16 X2= x1-x2
17 C= ((2/3)*A)-m*X
18 Y= m*X2+ C
19 //RESULTS
20 printf ('Water pressure on vertical face = %.f lbs ',
        P)
```

```

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

```

Scilab code Exa 10.2 chapter 10 example 2

```

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

```

Scilab code Exa 10.3 chapter 10 example 3

```

1  clc
2  //initialisation of variables
3  za= 16 //ft

```

```

4 h1= 2 //ft
5 h2= 3 //ft
6 g= 32.2 //ft/sec^2
7 //CALCULATIONS
8 vc= sqrt(2*g*(za-h1-h2))
9 vb= vc*(h1/(2*h1))^2
10 r= -h1-h2-(vb^2/(2*g))
11 r1= r+34
12 //RESULTS
13 printf ('pressure head at B= %.1f ft lb ',r1)

```

Scilab code Exa 10.4 chapter 10 example 4

```

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

```

Scilab code Exa 10.5 example 5

```

1 clc
2 //initialisation of variables
3 g= 32.2 //ft/sec^2
4 Cd= 0.62

```

```

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

```

Scilab code Exa 10.6 chapter 10 example 6

```

1
2 clc
3 //initialisation of variables
4 a= 60 //degrees
5 d= 4 //in
6 Cd= 0.62
7 h= 5 //ft
8 w= 30 //ft
9 g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 H1= 10*sind(a)
12 H2= H1-h
13 T= (2*w/tand(a))*(2/3)*(H1^(3/2)-H2^(3/2))/(Cd*sqrt
    (2*g)*%pi/(4*(d/12)^2))*100
14 //RESULTS
15 printf ('time required to lower water level= %.f
    secs ',T)

```

Scilab code Exa 10.7 chapter 10 example 7

```

1
2 clc

```

```

3 //initialisation of variables
4 p1= 40 //percent
5 p2= 35 //percent
6 dh= 200 //ft
7 f= 0.1
8 g= 32.2 //ft/sec^2
9 l= 2000 //ft
10 d= 1 //ft
11 //CALCULATIONS
12 hf1= p1*dh/100
13 hf2= p2*dh/100
14 hf3= (100-p1-p2)*dh/100
15 hft= hf1+hf2+hf3
16 v1= sqrt(2*g*hf1/(4*f*l))
17 Q= v1*%pi*d^2/4
18 d2= (Q*7*sqrt(3/(5*g)))^(2/3)
19 v3= Q*4*(4/3)^2/%pi
20 l3= hf2*2*g*(3/4)/(4*f*v3^2)
21 //RESULTS
22 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

```

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

```

```

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

```

Scilab code Exa 10.9 example 9

```

1 clc
2 //initialisation of variables
3 f= 0.01
4 d= 3 //in
5 l= 22 //ft
6 l1= 20 //ft
7 w= 20 //ft
8 h= 5 //ft
9 h1= 20 //ft
10 t= 4 //min
11 g= 32.2 //ft/sec^2
12 //CALCULATIONS
13 h2= h+h1
14 h3= (h-(t*60*%pi*sqrt(2*g/h)/(l1*w*2*64)))^2-4
15 dh= h2-h3
16 Q= dh*l1*w
17 //RESULTS
18 printf ('Quantiy discharged= %.f cuses ',Q)

```

Scilab code Exa 10.10 example 10

```

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

```
