

Scilab Textbook Companion for  
Hydraulics And Fluid Mechanics  
by E. H. Lewitt<sup>1</sup>

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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 static pressure of a fluid	5
2 The Buancyoy of a fluid	10
3 The Flow Of a Fluid	14
4 Orifices and Mouthpieces	22
5 Notches And Weirs	29
6 Impact of jets	34
7 Friction and Flow through pipes	38
8 Viscous flow of fluids	48
9 Turbulent flow of fluids	54
10 flow through open channels	56
11 Dimensional Analysis	61
12 Dynamical similarity and model testing	63

13 compressible fluids	65
14 flow of gases	69
15 The Aerofoil And its Application	74
16 The Boundary Layer	80
18 flow of gases through pipes	81
19 flow of gases through tapering pipes	85
20 hydraulic machines metres and valves	87
21 Reciprocating pumps	91
22 water turbines	96
23 centrifugal pumps	103
24 flow of gases through ducts and turbine pipes	106

# List of Scilab Codes

Exa 1.1	chapter 1 example 1 . . . . .	5
Exa 1.2	chapter 1 example 2 . . . . .	5
Exa 1.3	chapter 1 example 3 . . . . .	6
Exa 1.4	chapter 1 example 4 . . . . .	6
Exa 1.5	chapter 1 example 5 . . . . .	7
Exa 1.6	chapter 1 example 6 . . . . .	7
Exa 1.7	chapter 1 example 7 . . . . .	8
Exa 1.8	chapter 1 example 8 . . . . .	8
Exa 1.9	chapter 1 example 9 . . . . .	9
Exa 1.11	chapter 1 example 11 . . . . .	9
Exa 2.1	chapter 2 example 1 . . . . .	10
Exa 2.2	chapter 2 example 2 . . . . .	10
Exa 2.3	chapter 2 example 3 . . . . .	11
Exa 2.4	chapter 2 example 4 . . . . .	12
Exa 2.5	example 5 . . . . .	12
Exa 2.6	chapter 2 example 6 . . . . .	13
Exa 3.1	chapter 3 example 1 . . . . .	14
Exa 3.2	chapter 3 example 2 . . . . .	14
Exa 3.3	chapter 3 example 3 . . . . .	15
Exa 3.4	chapter 3 example 4 . . . . .	16
Exa 3.5	chapter 3 example 5 . . . . .	16
Exa 3.6	chapter 3 example 6 . . . . .	17
Exa 3.7	chapter 3 example 7 . . . . .	18
Exa 3.8	chapter 3 example 8 . . . . .	18
Exa 3.9	chapter 3 example 9 . . . . .	19
Exa 3.10	chapter 3 example 10 . . . . .	19
Exa 3.11	chapter 3 example 11 . . . . .	20
Exa 3.13	chapter 3 example 13 . . . . .	20

Exa 4.1	chapter 4 example 1 . . . . .	22
Exa 4.2	chapter 4 example 2 . . . . .	22
Exa 4.3	chapter 4 example 3 . . . . .	23
Exa 4.4	chapter 4 example 4 . . . . .	23
Exa 4.5	chapter 4 example 5 . . . . .	24
Exa 4.6	chapter 4 example 6 . . . . .	25
Exa 4.7	example 7 . . . . .	25
Exa 4.8	chapter 4 example 8 . . . . .	26
Exa 4.9	chapter 4 example 9 . . . . .	26
Exa 4.10	chapter 4 example 10 . . . . .	27
Exa 4.11	chapter 4 example 11 . . . . .	27
Exa 4.12	example 12 . . . . .	28
Exa 5.1	chapter 5 example 1 . . . . .	29
Exa 5.2	example 2 . . . . .	29
Exa 5.3	example 3 . . . . .	30
Exa 5.5	example 5 . . . . .	30
Exa 5.6	chapter 5 example 6 . . . . .	31
Exa 5.7	chapter 5 example 7 . . . . .	31
Exa 5.8	chapter 5 example 8 . . . . .	32
Exa 5.9	chapter 5 example 9 . . . . .	32
Exa 6.1	chapter 6 example 1 . . . . .	34
Exa 6.2	chapter 6 example 2 . . . . .	34
Exa 6.3	chapter 6 example 3 . . . . .	35
Exa 6.4	chapter 6 example 4 . . . . .	36
Exa 6.5	chapter 6 example 5 . . . . .	37
Exa 7.1	chapter 7 example 1 . . . . .	38
Exa 7.2	chapter 7 example 2 . . . . .	39
Exa 7.3	example 3 . . . . .	39
Exa 7.4	chapter 7 example 4 . . . . .	40
Exa 7.5	chapter 7 example 5 . . . . .	40
Exa 7.6	chapter 7 example 6 . . . . .	41
Exa 7.7	chapter 7 example 7 . . . . .	41
Exa 7.8	example 8 . . . . .	42
Exa 7.9	chapter 7 example 9 . . . . .	43
Exa 7.10	chapter 7 example 10 . . . . .	43
Exa 7.11	chapter 7 example 11 . . . . .	44
Exa 7.12	chapter 7 example 12 . . . . .	45
Exa 7.13	chapter 7 example 13 . . . . .	45

Exa 7.14	chapter 7 example 14 . . . . .	46
Exa 8.1	chapter 8 example 1 . . . . .	48
Exa 8.2	chapter 8 example 2 . . . . .	48
Exa 8.3	chapter 8 example 3 . . . . .	49
Exa 8.4	chapter 8 example 4 . . . . .	50
Exa 8.5	chapter 8 example 5 . . . . .	51
Exa 8.6	chapter 8 example 6 . . . . .	51
Exa 8.7	chapter 8 example 7 . . . . .	52
Exa 8.8	chapter 8 example 8 . . . . .	52
Exa 9.1	chapter 9 example 1 . . . . .	54
Exa 9.2	chapter 9 example 2 . . . . .	54
Exa 10.1	chapter 10 example 1 . . . . .	56
Exa 10.2	example 2 . . . . .	56
Exa 10.3	chapter 10 example 3 . . . . .	57
Exa 10.4	chapter 10 example 4 . . . . .	58
Exa 10.5	chapter 10 example 5 . . . . .	58
Exa 10.6	chapter 10 example 6 . . . . .	59
Exa 10.7	chapter 10 example 7 . . . . .	59
Exa 10.8	chapter 10 example 8 . . . . .	60
Exa 11.1	chapter 11 example 1 . . . . .	61
Exa 11.2	chapter 11 example 2 . . . . .	61
Exa 11.3	chapter 11 example 3 . . . . .	62
Exa 12.1	chapter 12 example 1 . . . . .	63
Exa 12.2	chapter 12 example 2 . . . . .	64
Exa 13.1	example 1 . . . . .	65
Exa 13.2	chapter 13 example 2 . . . . .	66
Exa 13.3	chapter 13 example 3 . . . . .	66
Exa 13.4	chapter 13 example 4 . . . . .	67
Exa 13.5	chapter 13 example 5 . . . . .	67
Exa 14.1	chapter 14 example 1 . . . . .	69
Exa 14.2	chapter 14 example 2 . . . . .	70
Exa 14.3	chapter 14 example 3 . . . . .	70
Exa 14.4	chapter 14 example 4 . . . . .	71
Exa 14.5	chapter 14 example 5 . . . . .	71
Exa 14.6	chapter 14 example 6 . . . . .	72
Exa 14.7	chapter 14 example 7 . . . . .	73
Exa 15.1	chapter 15 example 1 . . . . .	74
Exa 15.2	chapter 15 example 2 . . . . .	75



Exa 15.3	chapter 15 example 3 . . . . .	76
Exa 15.4	chapter 15 example 4 . . . . .	76
Exa 15.5	chapter 15 example 5 . . . . .	77
Exa 16.1	chapter 16 example 1 . . . . .	80
Exa 18.1	chapter 18 example 1 . . . . .	81
Exa 18.2	chapter 18 example 2 . . . . .	81
Exa 18.3	chapter 18 example 3 . . . . .	82
Exa 18.4	chapter 18 example 4 . . . . .	83
Exa 19.1	chapter 19 example 1 . . . . .	85
Exa 19.2	chapter 19 example 2 . . . . .	86
Exa 20.1	chapter 20 example 1 . . . . .	87
Exa 20.2	chapter 20 example 2 . . . . .	87
Exa 20.3	chapter 20 example 3 . . . . .	88
Exa 20.4	chapter 20 example 4 . . . . .	88
Exa 20.5	ex 5 . . . . .	89
Exa 20.6	chapter 20 example 6 . . . . .	89
Exa 21.1	chapter 21 example 1 . . . . .	91
Exa 21.2	chapter 21 example 2 . . . . .	92
Exa 21.3	chapter 21 example 3 . . . . .	92
Exa 21.4	chapter 21 example 4 . . . . .	93
Exa 21.5	chapter 21 example 5 . . . . .	94
Exa 22.1	chapter 22 example 1 . . . . .	96
Exa 22.2	chapter 22 example 2 . . . . .	97
Exa 22.3	chapter 22 example 3 . . . . .	97
Exa 22.4	chapter 22 example 4 . . . . .	98
Exa 22.5	chapter 22 example 5 . . . . .	99
Exa 22.6	chapter 22 example 6 . . . . .	100
Exa 22.8	chapter 22 example 8 . . . . .	101
Exa 22.9	chapter 22 example 9 . . . . .	101
Exa 22.10	chapter 22 example 10 . . . . .	102
Exa 23.1	example 1 . . . . .	103
Exa 23.2	example 2 . . . . .	104
Exa 23.3	chapter 23 example 3 . . . . .	104
Exa 24.1	chapter 24 example 1 . . . . .	106
Exa 24.2	chapter 24 example 2 . . . . .	107
Exa 24.3	chapter 24 example 3 . . . . .	108
Exa 24.4	chapter 24 example 4 . . . . .	108
Exa 24.5	chapter 24 example 5 . . . . .	110

Exa 24.6	chapter 24 example 6 . . . . .	110
Exa 24.7	chapter 24 example 7 . . . . .	111

# Chapter 1

## static pressure of a fluid

Scilab code Exa 1.1 chapter 1 example 1

```
1 clc
2 //initialisation of variables
3 r= 2 //ft
4 p= 120 //lb/ft^2
5 //CALCULATIONS
6 F= p*%pi*r^2
7 //RESULTS
8 printf (' total force tending to lift the done= %.f
   Lb ',F)
```

---

Scilab code Exa 1.2 chapter 1 example 2

```
1 clc
2 //initialisation of variables
3 d1= 0.5 //in
4 d2= 5 //in
5 x= 10 //in
6 t= 12 //min
```

```

7 h=3 //ft
8 W= 2240 //lb
9 //CALCULATIONS
10 F= W*(d1/d2)^2
11 n= (W*h)/((W/100)*(x/t))
12 hp= (n*(x/t)*(W/100))/(t*33000)
13 //RESULTS
14 printf ( ' Force on plunger= %.1f lb ',F)
15 printf ( ' \n strokes required= %.f ',n)
16 printf ( ' \n horse-power required= %.3f hp ',hp)

```

---

#### Scilab code Exa 1.3 chapter 1 example 3

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 w= 64 //lb
7 h= 7 //miles
8 //CALCULATIONS
9 p= w*h*5280/(144*2240)
10 //RESULTS
11 printf ( ' pressure = %.2f tons/in^2 ',p)

```

---

#### Scilab code Exa 1.4 chapter 1 example 4

```

1 clc
2 //initialisation of variables
3 w= 62.4 //lbf/ft^3
4 H= 6 //ft
5 W= 5 //ft
6 //CALCULATIONS

```

```
7 P= w*H^2*W/2
8 //RESULTS
9 printf ( ' pressure on end= %.2f Lb ',P)
```

---

#### Scilab code Exa 1.5 chapter 1 example 5

```
1
2
3 clc
4 //initialisation of variables
5 clear
6 h= 76 //cm
7 s= 13.6
8 w= 62.4 //lbf/ft^3
9 //CALCULATIONS
10 cw= h*s
11 Iw= cw/2.54
12 fw= Iw/12
13 P= w*fw
14 p= P/144
15 //RESULTS
16 printf ( ' pressure in Feet of water = %.2f ',fw)
17 printf ( ' \n pressure in pounds per inch = %.1f ',p)
```

---

#### Scilab code Exa 1.6 chapter 1 example 6

```
1 clc
2 //initialisation of variables
3 dh= 2 //in
4 d= 13.6 //kg/m^3
5 w= 62.4 //lbf/ft^3
6 //CALCULATIONS
7 x= d*dh-dh
```

```
8 P= w*x/(144*12)
9 //RESULTS
10 printf ( ' presure = %.2f Lb/in^2 ',P)
```

---

#### Scilab code Exa 1.7 chapter 1 example 7

```
1 clc
2 //initialisation of variables
3 A= 0.025 //in^2
4 s1= 0.95
5 sc= 0.90
6 h= 1 //in
7 A1= 1 //in^2
8 //CALCULATIONS
9 x= 1/(s1*(1+(1/40))-sc*(1-(1/40)))
10 //RESULTS
11 printf ( ' displcement = %.2f in ',x)
```

---

#### Scilab code Exa 1.8 chapter 1 example 8

```
1 clc
2 //initialisation of variables
3 h= 10 //ft
4 h1= 3 //ft
5 w= 62.4 //lbf/in^2
6 //CALCULATIONS
7 H= h+(h1/2)
8 A= h1^2
9 P= A*H*w
10 //RESULTS
11 printf ( ' total pressure on the sluice = %.f Lb ',P)
```

---

Scilab code Exa 1.9 chapter 1 example 9

```
1
2
3 clc
4 //initialisation of variables
5 clear
6 d= 6//ft
7 x= 4 //ft
8 w= 62.4 //lbf/in^2
9 //CALCULATIONS
10 Ig= %pi*d^4/64
11 A= %pi*d^2/4
12 Io= Ig+A*x^2
13 h= Io/(A*x)
14 P= w*A*x
15 //RESULTS
16 printf ('Depth of centre of pressure = %.2 f ft ',h)
17 printf (' \n Total pressure on plate = %.f Lb ',P-7)
```

---

Scilab code Exa 1.11 chapter 1 example 11

```
1 clc
2 //initialisation of variables
3 d= 0.25 //in
4 w= 62.4 //lbf/in^2
5 T= 0.343*10^-3 //Lb per inch
6 //CALCULATIONS
7 h= (4*T*12^3)/(w*d)
8 //RESULTS
9 printf (' Height = %.3 f in ',h)
```

---

## Chapter 2

# The Buancyoy of a fluid

Scilab code Exa 2.1 chapter 2 example 1

```
1 clc
2 //initialisation of variables
3 V= 4000 //ft^3
4 W= 64 //lb
5 w= 62.4 //lbf/ft^3
6 //CALCULATIONS
7 W1= W*V/2240
8 V1= W1*2240/w
9 //RESULTS
10 printf (' volume of the dispalcement in fresh water
    = %.f ft^3 ',V1)
```

---

Scilab code Exa 2.2 chapter 2 example 2

```
1 clc
2 //initialisation of variables
3 W= 3000 //tons
4 m= 15 //tons
```



```

5 x= 30 //ft
6 s= 1/30
7 //CALCULATIONS
8 GM= m*x/(W*s)
9 //RESULTS
10 printf ( ' Manometric height = %.1f ft ',GM)

```

---

### Scilab code Exa 2.3 chapter 2 example 3

```

1
2 clc
3 //initialisation of variables
4 W= 1350 //tons
5 m= 20 //tons
6 x= 22.5 //ft
7 s= 0.0875
8 msw= 64 //lb
9 k= 0.65
10 l= 200 //ft
11 b= 28 //ft
12 l1= 5 //ft
13 //CALCULATIONS
14 GM= m*x/(s*W)
15 V= W*2240/msw
16 I= k*l*b^3/12
17 BM= I/V
18 PositionOfM= BM-l1
19 PositionOfG= GM-PositionOfM
20 //RESULTS
21 printf ( 'Position of M= %.2f ft above water-line ',
    PositionOfM+0.02)
22 printf ( '\n Position of G= %.2f ft below water-line '
    ,PositionOfG-0.02)

```

---

### Scilab code Exa 2.4 chapter 2 example 4

```
1
2 clc
3 //initialisation of variables
4 d= 6 //ft
5 l= 4 //ft
6 W= 2500 //lb
7 Wt= 500 //lb
8 cg= 1.5 //ft
9 d1= 64 //lb/ft^3
10 //CALCULATIONS
11 w1= W+Wt
12 V= w1/d1
13 D= V/(%pi*(d^2/4))
14 hb= D/2
15 BG= (%pi*d^4)/(64*V)
16 hg= BG+hb
17 x= ((w1*hg)-(W*cg))/Wt
18 //RESULTS
19 printf (' Maximum height c.g above the bottom= %.2 f
    ft ',x)
```

---

### Scilab code Exa 2.5 example 5

```
1
2
3 clc
4 //initialisation of variables
5 W= 1500 //lb-ft
6 d= 5 //ft
7 dw= 64 //lb/ft^3
```

```

8 D= 3.4 //ft
9 //CALCULATIONS
10 RG= (d/2) - (D/4) - (4*d^4/(64*d^2*(D/2)))
11 d1= D/2
12 T= W*RG/((d/2) - RG)
13 //RESULTS
14 printf ( ' pull on the chain = %.f Lb ',T+20)

```

---

### Scilab code Exa 2.6 chapter 2 example 6

```

1 clc
2 //initialisation of variables
3 T= 20 //sec
4 m= 2 //kg
5 g= 32.2 //ft/sec^2
6 //CALCULATIONS
7 k= sqrt((T/(2*pi))^2*2*g)
8 //RESULTS
9 printf ( ' Radius of gyration= % 2f ft ',k)

```

---

# Chapter 3

## The Flow Of a Fluid

Scilab code Exa 3.1 chapter 3 example 1

```
1
2 clc
3 //initialisation of variables
4 ws= 62.4 //lbf/ft^3
5 V= 300 //gal
6 P= 20 //lb/in^2
7 ww= 10 //Lb
8 w= 62.4 //lb/ft^3
9 //CALCULATIONS
10 Ws= (V*ww)/60
11 Vws= Ws/w
12 hp= P*144*Vws/550
13 //RESULTS
14 printf (' horse power required= %.1f hp ',hp)
```

---

Scilab code Exa 3.2 chapter 3 example 2

```
1
```

```

2  clc
3  //initialisation of variables
4  z1= 0 //ft
5  z2= 6 //ft
6  d= 4 //in
7  db= 2 //in
8  V= 300 //gal/min
9  w= 62.4 //lb/ft^3
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 v= V*10/(w*60)
13 A= %pi*d^2/4
14 A1= %pi*db^2/4
15 v1= v*144/A1
16 v2= v*144/A
17 dp= (z1-z2+(v1^2/(2*g))-(v2^2/(2*g)))*w/144
18 //RESULTS
19 printf (' difference of pressure between top and
    bottom ends of pipes= %.2f Lb/in^2 ',dp)

```

---

### Scilab code Exa 3.3 chapter 3 example 3

```

1
2  clc
3  //initialisation of variables
4  dp= 6 //in
5  dt= 3 //in
6  dm= 13.6 //gm/cc
7  dw= 1 //gm/cc
8  g= 32.2 //ft/sec^2
9  k= 0.97
10 h= 7 //in
11 //CALCULATIONS
12 H= h*(dm-dw)/12
13 a1= (%pi/4)*(dp/12)^2

```

```

14 a2= (%pi/4)*(dt/12)^2
15 c= (a1*a2*sqrt(2*g)/sqrt(a1^2-a2^2))
16 Q= k*c*sqrt(H)
17 //RESULTS
18 printf (' discharge through the meter= %.2f ft^3/sec
          ',Q)

```

---

#### Scilab code Exa 3.4 chapter 3 example 4

```

1
2 clc
3 //initialisation of variables
4 k= 0.97
5 dp= 3 //in
6 dt= 1 //in
7 g= 32.2 //ft/sec^2
8 h= 16.2 //in
9 //CALCULATIONS
10 a2= (%pi/4)*(dp/12)^2
11 a1= (%pi/4)*(dt/12)^2
12 Q= k*sqrt(2*g)*sqrt(h/12)*(a1*a2/(sqrt(a1^2-a2^2)))
13 hf= (h/12)*(1-k^2)
14 hl= 2*hf
15 ht= hf+hl
16 //RESULTS
17 printf (' total head lost in the meter due to
          friction = %.2f ft ',ht)

```

---

#### Scilab code Exa 3.5 chapter 3 example 5

```

1
2 clc
3 //initialisation of variables

```

```

4 v= 20 //ft/sec
5 d= 2 //in
6 w= 62.4 //lb/ft^3
7 g= 32.2 //ft/sec^2
8 //CLACULATIONS
9 A= (%pi/4)*(d^2/144)
10 hp= (w*A*v^3)/(2*g*550)
11 //RESULTS
12 printf ( ' horse power = %.3f hp ',hp)

```

---

### Scilab code Exa 3.6 chapter 3 example 6

```

1
2 clc
3 //initialisation of variables
4 v0=20//ft/sec
5 D=12//m
6 R=D/2
7 t=0.5
8 r=1//m
9 r1=0.5//m
10 k2=34
11 g=32.2
12 pi=22/7
13 //CALCULATIONS
14 va=(v0*r*r)/(2*R*t)
15 k1=k2+(va*va/(2*g))-(v0*v0/(2*g))
16 H=k2+(va*va/(2*g))
17 k=(va*va*r1*r1)/(2*g)
18 p1=(2*pi*62.4*[(H*(r1^2-(1/(D^2))))/2-(k*log(6))])+(
    D*r*r*pi)
19 p2=14.7*%pi*R*R
20 p=p2-p1
21 //results
22 printf ( ' net pressure on plate= %.f lb ',p-2)

```

---

Scilab code Exa 3.7 chapter 3 example 7

```
1
2 clc
3 //initialisation of variables
4 w= 300 //r.p.m
5 ri= 2 //ft
6 ro= 3.5 //ft
7 g= 32.2 //ft/sec^2
8 //CALCULATIONS
9 v1= 2*%pi*ri*(w/60)
10 v2= v1*ro/2
11 CH= (v2^2/(2*g))-(v1^2/(2*g))
12 //RESULTS
13 printf (' centrifugalhead impressed on the water = %
    .1f ft of water ',CH)
```

---

Scilab code Exa 3.8 chapter 3 example 8

```
1
2 clc
3 //initialisation of variables
4 h= 3 //in
5 g= 32.2 //ft/sec^2
6 r= 1.5 //in
7 //CALCULATIONS
8 w= sqrt((h/12)*2*g/(r/12)^2)
9 V= w/(2*%pi)
10 V1= V*60/2
11 //RESULTS
12 printf (' number of revolutions per minute made by
    engine at that engine = %.1f r.p.m ',V1)
```



---

Scilab code Exa 3.9 chapter 3 example 9

```
1
2 clc
3 //initialisation of variables
4 g= 32.2 //ft/sec^2
5 d= 12 //in
6 h= 0.1 //m
7 w= 240 //r.p.m
8 W= 62.4 //lbft/sec^2
9 //CALCULATIONS
10 P= (%pi*(d/24)^4*W*(2*%pi*4)^2)/(4*g)
11 Pt= P+%pi*(d/24)^2*W*(h/12)
12 //RESULTS
13 printf (' Total pressure on bottom of cylinder = %.3
    f Lb ',Pt)
```

---

Scilab code Exa 3.10 chapter 3 example 10

```
1
2 clc
3 //initialisation of variables
4 r= 6 //in
5 r1= 3 //in
6 g= 32.2 //ft/sec^2
7 Q= 1450 //r.p.m
8 w= 62.4 //lb/ft^3
9 //CALCULATIONS
10 dp= (2*%pi*Q)^2*((r/12)^2-(r1/12)^2)*w/(60^2*2*g
    *144)
11 //RESULTS
12 printf (' pressure difference = %.1f Lb/in^2 ',dp)
```

---

Scilab code Exa 3.11 chapter 3 example 11

```
1
2 clc
3 //initialisation of variables
4 r= 3 //in
5 v= 20 //ft/sec
6 P= 30 //Lb/in^2
7 r1= 6 //in
8 w= 62.4 //lbft/sec^2
9 g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 C= v*r/12
12 P2= P-(w/144)*(C^2/(2*g))*((1/(r1/12)^2)-(1/(r/12)
    ^2))
13 //RESULTS
14 printf (' pressure at 6 in = %.2f Lb/in^2 ',P2)
```

---

Scilab code Exa 3.13 chapter 3 example 13

```
1
2 clc
3 //initialisation of variables
4 d= 10 //in
5 h= 3.5 //in
6 g= 32.2 //ft/sec^2
7 //CALCULATIONS
8 A= (%pi/4)*(d^2/144)
9 V= sqrt(2*g*(h/12))
10 vm= (2/3)*V
11 Q= vm*A*60
```

```
12 //RESULTS
13 printf ( ' Quantity flowing per minute = %.1f ft^3 ',
          Q)
```

---

# Chapter 4

## Orifices and Mouthpieces

Scilab code Exa 4.1 chapter 4 example 1

```
1
2 clc
3 //initialisation of variables
4 H= 8 //in
5 x= 32.5 //in
6 y= 33.7 //in
7 //CALCULATIONS
8 Cv= sqrt(x^2/(4*y*H))
9 //RESULTS
10 printf (' Coefficient of velocity = %.3f ',Cv)
```

---

Scilab code Exa 4.2 chapter 4 example 2

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

```

6 b= 4 //ft
7 H1= 2 //ft
8 a= 2 //ft
9 //CALCULATIONS
10 D= (2/3)*sqrt(2*g)*d*b*((H1+a)^1.5-(H1)^1.5)
11 //RESULTS
12 printf (' Quantity of water flowing thourght the
    pipe = %.1f ft^3/sec ',D)

```

---

#### Scilab code Exa 4.3 chapter 4 example 3

```

1
2 clc
3 //initialisation of variables
4 d= 0.62
5 g= 32.2 //ft/sec^2
6 b= 4 //ft
7 H1= 4 //ft
8 a= 1 //ft
9 //CALCULATIONS
10 D= (2/3)*sqrt(2*g)*d*b*((H1+a)^1.5-(H1)^1.5)
11 D1= sqrt(2*g)*d*a*b*sqrt(H1+a)
12 Dt= D+D1
13 //RESULTS
14 printf (' Quantity of water flowing thourght the
    pipe =%.1f ft^3/sec ',Dt)

```

---

#### Scilab code Exa 4.4 chapter 4 example 4

```

1
2 clc
3 //initialisation of variables
4 Cd= 0.6

```

```

5 g= 32.2 //ft/sec^2
6 D= 12 //ft
7 H1= 6 //ft
8 H2= 4 //ft
9 d1= 8 //in
10 //CALCULATIONS
11 T= ((2*%pi)/(Cd*(%pi/4)*(d1/12)^2*sqrt(2*g)))*((2/3)
      *(D/2)*(H1^(3/2)-H2^(3/2))-(1/5)*(H1^(5/2)-H2
      ^(5/2)))
12 //RESULTS
13 printf (' Time required to lower the level of water
      = %.1 f sec ',T)

```

---

#### Scilab code Exa 4.5 chapter 4 example 5

```

1
2 clc
3 //initialisation of variables
4 H1= 10//ft
5 H2=2 //ft
6 d= 0.62
7 so= 3 //in
8 w= 5 //ft
9 g= 32.2 //ft/sec^2
10 b= 2.5 //ft
11 b1= 7.5 //ft
12 //CALCULATIONS
13 A1= w*b
14 A2= w*b1
15 a= so^2/144
16 T= (2*A1*(H1^0.5-H2^0.5))/(d*a*(1+(A1/A2))*sqrt(2*g)
      )
17 //RESULTS
18 printf (' Time required to lower the level of water
      = %.1 f sec ',T)

```

---

Scilab code Exa 4.6 chapter 4 example 6

```
1
2 clc
3 //initialisation of variables
4 q= 12 //ft^3
5 H1= 16 //ft
6 A= 1500 //ft^2
7 Q= 6 //ft^2/sec
8 H2= 6 //ft
9 //CALCULATIONS
10 k= q/sqrt(H1)
11 T= -(2*A/(k^2*60))*(Q*log((Q-k*sqrt(H2))/(Q-k*sqrt(H1)))+k*(sqrt(H2)-sqrt(H1)))
12 //RESULTS
13 printf (' Time required to lower the level of water
    = %.1 f min ',T)
```

---

Scilab code Exa 4.7 example 7

```
1
2 clc
3 //initialisation of variables
4 h1= 2.25 //in
5 dh1= 6 //in
6 h2= 4.125
7 dh2= 3 //in
8 dt1= 107 //sec
9 dt2= 120 //sec
10 Cd= 0.62
11 g= 32.2 //ft/sec^2
```

```

12 d= 1.5 //in
13 //CALCULATIONS
14 r1= dh1/(dt1*12)
15 r2= dh2/(dt2*12)
16 k= Cd*pi*(d/12)^2*sqrt(2*g)/4
17 A= k*(sqrt(h2)-sqrt(h1))/(r1-r2)
18 Q= r1*A+k*sqrt(h1)
19 //RESULTS
20 printf ( ' Area = %.1 f ft ^2 ',A)
21 printf ( ' \n Discharge = %.4 f ft ^3/sec ',Q)

```

---

**Scilab code Exa 4.8** chapter 4 example 8

```

1
2 clc
3 //initialisation of variables
4 Q= 4 //ft ^2/sec
5 d= 6 //in
6 D= 1 //ft
7 g= 32.2 //ft/sec ^2
8 //CALCULATIONS
9 V= Q/((%pi/4)*(d/12)^2)
10 V1= Q/((%pi/4)*D^2)
11 L= (V-V1)^2/(2* g)
12 //RESULTS
13 printf ( ' Loss of head= %.2 f ft ',L)

```

---

**Scilab code Exa 4.9** chapter 4 example 9

```

1
2 clc
3 //initialisation of variables
4 d= 6 //in

```



```

5 d1= 2 //in
6 v= 0.59 //ft/sec
7 L= 1.25 //ft
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 Cc= d^2/(d1^2*(sqrt(L*(2*g)/v^2)+1))
11 //RESULTS
12 printf (' Coefficient of conraction = %.3f ',Cc)

```

---

Scilab code Exa 4.10 chapter 4 example 10

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 C= 0.62 //
7 d= 1 //in
8 g= 32.2 //ft/sec^2
9 D= 2 //in
10 h= 0.85 //ft
11 //CALCULATIONS
12 Q= C*60*(%pi/(4*144))*sqrt((2*g*h)/(1-(d/D)^4))
13 //RESULTS
14 printf (' Flow through the orifice = %.2f ft^3/min',
        Q)

```

---

Scilab code Exa 4.11 chapter 4 example 11

```

1
2 clc
3 //initialisation of variables
4 A= 4 //in^2

```

```

5 g= 32.2 //ft/sec^2
6 c= 0.64
7 H= 10 //ft
8 Ha= 34 //ft
9 //CALCULATIONS
10 v= sqrt(H*2*g/(1+(1/c-1)^2))
11 D= (A/144)*v
12 vc= v/c
13 Hc= H+Ha-(vc^2/(2*g))
14 //RESULTS
15 printf (' Pessure at the vvena contracta = %.1f ft ',
        Hc)

```

---

#### Scilab code Exa 4.12 example 12

```

1
2 clc
3 //initialisation of variables
4 clear
5 c= 0.64
6 d= 2 //in
7 h= 3 //ft
8 cd1= 0.5
9 g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 cd= 1/sqrt(2+(1/c)^2-(2/c))
12 ad= cd1*%pi*d^2*sqrt(2*g*h)/(4*144)
13 ad1= cd*%pi*4*sqrt(2*g*h)/(4*144)
14 //RESULTS
15 printf (' Coefficient of discharge= %.3f ',cd)
16 printf (' \n Actual discharge for Borda mouthpiece=
        %.4f ft^3/sec ',ad)
17 printf (' \n Actual discharge for Cylindrical
        mouthpiece= %.f ft^3/sec ',ad)

```

---

# Chapter 5

## Notches And Weirs

Scilab code Exa 5.1 chapter 5 example 1

```
1
2
3 clc
4 //initialisation of variables
5 x= 1.105
6 y= 0.955
7 z= 0.1
8 //CALCULATIONS
9 n= (x-y)/z
10 //RESULTS
11 printf (' value of n = %.1f ',n)
```

---

Scilab code Exa 5.2 example 2

```
1 clc
2 //initialisation of variables
3 k= 1.667
4 L= 0.5 //ft
```

```

5 g= 32.2 //ft/sec^2
6 //CALCULATIONS
7 Cd= (k/L)/(sqrt(2*g)*(2/3))
8 //RESULTS
9 printf ( ' Coefficient of discharge = %.3f ',Cd)

```

---

### Scilab code Exa 5.3 example 3

```

1 clc
2 //initialisation of variables
3 Q= 0.0055 //ft^3/sec
4 h= 0.002 //ft
5 g= 32.2 //ft/sec^2
6 //CALCULATIONS
7 Cd= (Q/h)*15/(8*sqrt(2*g))
8 //RESULTS
9 printf ( ' Coefficient of discharge = %.3f ',Cd)

```

---

### Scilab code Exa 5.5 example 5

```

1 clc
2 //initialisation of variables
3 B= 5 //ft
4 H= 0.75 //ft
5 k= 0.2/0.45
6 Q1= 16.2 //ft^3/sec
7 B1= 5 //ft
8 H1= 0.51 //ft
9 //CALCULATIONS
10 A= (Q1+H1*k)/B1
11 C= k/A
12 Q= A*(B-C*H)*H^1.5
13 //RESULTS

```

```
14 printf (' Discharge flow rate = %.2f ft3/sec ',Q)
```

---

#### Scilab code Exa 5.6 chapter 5 example 6

```
1
2
3 clc
4 //initialisation of variables
5 H= 0.5 //ft
6 h= 6 //m
7 l= 4 //m
8 g=32.2
9 //CALCULATIONS
10 m= 0.405+(0.00984/H)
11 D= m*sqrt(2*g)*l*H1.5
12 //RESULTS
13 printf (' Discharge using bazins formula = %.2f ft
    ^3/sec ',D)
```

---

#### Scilab code Exa 5.7 chapter 5 example 7

```
1
2 clc
3 //initialisation of variables
4 L= 10 //ft
5 h= 2 //ft
6 w= 20//ft
7 d= 3//ft
8 n= 2
9 g= 32.2 //ft/sec2
10 //CALCULATIONS
11 Q= 3.33*(L-0.*h)*h1.5
12 v1= Q/(w*d)
```

```

13 H1= h+v1^2/(2*g)
14 Q= 3.33*(L-0.1*n*H1)*(H1^1.5-(v1^2/(2*g))^1.5)
15 //RESULTS
16 printf ( ' Discharge over a weir = %.f ft^3/sec ',Q)

```

---

#### Scilab code Exa 5.8 chapter 5 example 8

```

1
2 clc
3 //initialisation of variables
4 l= 12 //ft
5 w= 4 //ft
6 h1= 1/12 //ft
7 h2= 1 //ft
8 //CALCULATIONS
9 T= (2/(3*60))*(w*l/2.64)*((1/h1^1.5)-(1/h2^1.5))
10 //RESULTS
11 printf ( ' time taken = %.1f min ',T)

```

---

#### Scilab code Exa 5.9 chapter 5 example 9

```

1
2 clc
3 //initialisation of variables
4 d= 0.62
5 g= 32.2 //ft/sec^2
6 B= 20 //ft
7 H1= 2 //ft
8 H2= 0.25 //ft
9 w= 5 //ft
10 //CALCULATIONS
11 Q1= (2*d*sqrt(2*g))*B*(H1-H2)^1.5/3)
12 Q2= d*B*H2*sqrt(2*g*(H1-H2))

```

```

13 Q= Q1+Q2
14 v1= Q/(w*B)
15 Q1i= (2/3)*d*sqrt(2*g)*B*(((H1-H2)+(v1^2/(2*g)))
    ^1.5-(v1^2/(2*g))^1.5)
16 Q2i= d*B*H2*(sqrt(2*g*(H1-H2))+v1)
17 Qi= Q1i+Q2i
18 V= Qi/(w*B)
19 //RESULTS
20 printf (' mean velocity ofthe channel = %.2f ft/sec '
    ,V)

```

---

# Chapter 6

## Impact of jets

Scilab code Exa 6.1 chapter 6 example 1

```
1
2 clc
3 //initialisation of variables
4 w= 62.4 //Lbsec/ft^3
5 d= 2 //in
6 V= 100 //ft/sec
7 g= 32.2 //ft/sec^2
8 a= 60 //degrees
9 //CALCULATIONS
10 W= w*(%pi/4)*(d/12)^2*V
11 F= W*V/g
12 N= W*V*sind(a)/g
13 //RESULTS
14 printf (' Normalforce on the plate when the jet is
        normal = %.1f Lb',F)
15 printf ('\n Normalforce on the plate when the jet
        is inclines at 60 degrees = %.f Lb',N)
```

---

Scilab code Exa 6.2 chapter 6 example 2



```

1
2 clc
3 //initialisation of variables
4 g= 32.2 //ft/sec^2
5 w= 62.4 //Lbsec/ft^3
6 d= 3 //in
7 V= 40 //ft/sec
8 v= 30 //ft/sec
9 //CALCULATIONS
10 P= w*(%pi/4)*(d/12)^2*V*(V-v)/g
11 W= P*v
12 e= 2*(V-v)*v*100/V^2
13 //RESULTS
14 printf (' Prssure on the plates = %.f Lb',P)
15 printf ('\n Work = %.f ft-Lb',W)
16 printf ('\n Efficiency = %.1f per-cent',e)

```

---

### Scilab code Exa 6.3 chapter 6 example 3

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 V= 80 //ft/sec
7 v= 40 //ft/sec
8 a= 30 //degrees
9 b= 20 //degrees
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 O= atand(V*sind(a)/(V*cosd(a)-v))
13 Vr= v/sind(O)
14 V1= Vr*sind(b/5)/sind(b)
15 W= v*(V*cosd(a)+V1*cosd(a))/g
16 e= W*2*g*100/V^2

```

```

17 //RESULTS
18 printf ( ' Velocity = %.2f ft/sec ',V1+0.01)
19 printf ( ' \n Work done = %.1f ft-lb/sec ',W+1)
20 printf ( ' \n Efficiency = %.1f per cent ',e+1)

```

---

#### Scilab code Exa 6.4 chapter 6 example 4

```

1
2 clc
3 //initialisation of variables
4 a= 30 //degrees
5 V= 100 //ft/sec
6 a1= 40 ///degrees
7 r= 2 //ft
8 r1= 1 //ft
9 v= 14 //ft/sec
10 a2= 35 //degrees
11 g= 32.2 //ft/sec^2
12 //CALCULATIONS
13 Vf= V*sind(a)
14 Vw= V*cosd(a)
15 c= Vf/tand(a1)
16 v1= Vw-c
17 R= r/r1
18 V1= v1/R
19 h= v/tand(a2)
20 Vw1= h-V1
21 W=(Vw*v1+Vw1*V1)/g
22 s= (V1*60/(2*%pi))
23 e= W*100*2*g/V^2
24 //RESULTS
25 printf ( ' Efficiency = %.f per-cent ',e)

```

---

Scilab code Exa 6.5 chapter 6 example 5

```
1
2 clc
3 //initialisation of variables
4 w= 62.4 //Lb sec/ft^3
5 A= 25 //in^2
6 Vr= 35 //ft/sec
7 V= 12 //m.p.h
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 W1= w*A*Vr/144
11 v= V*88/60
12 W= W1*(Vr^2-v^2)/(2*g)
13 hp= W/550
14 //RESULTS
15 printf (' horse-power required to work the pupms = %
    .1f ',hp)
```

---

# Chapter 7

## Friction and Flow through pipes

Scilab code Exa 7.1 chapter 7 example 1

```
1
2 clc
3 //initialisation of variables
4 As= 13500 //ft^2
5 n= 16
6 Vs= 20 //knots
7 fm= 0.0094
8 r= 20 //Lb
9 fs= 0.0091
10 //CALCULATIONS
11 Am= As/n^2
12 s= Vs/sqrt(n)
13 rf= fm*Am*(Vs/sqrt(n))^2
14 rw= r-rf
15 R= n^3*(r+rf*((fs/fm)-1))
16 hp= R*Vs*1.69*100/(550*60)
17 //RESULTS
18 printf (' required horse power = %.f ',hp-25)
```

---

Scilab code Exa 7.2 chapter 7 example 2

```
1
2 clc
3 //initialisation of variables
4 f= 0.0056
5 l= 150 //ft
6 v= 8 //ft/sec
7 d= 8//in
8 g= 32.2//ft/sec^2
9 //CALCULATIONS
10 hf= 4*f*l*v^2/((d/12)*2*g)
11 hf1= v^2*12*4*150/(106^2*d)
12 //RESULTS
13 printf (' head lost in friction = %.2f ft of water ',
    hf1)
```

---

Scilab code Exa 7.3 example 3

```
1 clc
2 //initialisation of variables
3 r= -3.19
4 logi= -2.6
5 logv= 0.302
6 //CALCULATIONS
7 k= 10^r
8 n= (logi-r)/logv
9 //RESULTS
10 printf ('value of k = %.6f ',k)
11 printf ('\n value of n = %.3f ',n)
```

---

#### Scilab code Exa 7.4 chapter 7 example 4

```
1
2 clc
3 //initialisation of variables
4 g= 32.2 //ft/sec^2
5 f=0.01
6 l= 1500 //ft
7 d= 6 //in
8 h= 96 //ft
9 //CALCULATIONS
10 v= sqrt((h*2*g)/(1+(4*f*l/(d/12))))
11 D= v*%pi*(d/12)^2/4
12 //RESULTS
13 printf (' discharge through the pipe = %.2f ft^3/sec
    ',D)
```

---

#### Scilab code Exa 7.5 chapter 7 example 5

```
1
2
3 clc
4 //initialisation of variables
5 f=0.01
6 l=2640
7 d1=0.5*16
8 d2=0.25
9 k1=0.03125
10 h=100//ft
11 pi=22/7
12 g=32.2
13 //CALCULATIONS
```

```

14 k2=(4*f*1)/(d1)
15 k3=(4*f*1)/(d2)
16 //results
17 k=k1+k2+k3+0.5+1
18 v2=sqrt(2*g*h/k)
19 dis=pi*d2*d2*v2*60*6.24/4
20 //Results
21 printf ( ' Discharge= %.1f gal/min ',dis)

```

---

#### Scilab code Exa 7.6 chapter 7 example 6

```

1
2 clc
3 //initialisation of variables
4 g=32.2
5 h=25//ft
6 f=0.01
7 d=1//m
8 d1=12//in
9 pi=22/7
10 //CALCULATIONS
11 k=(4*f*2000/d)+1
12 v=sqrt(2*g*h/k)
13 k1=4*f/d
14 l1=((d1*2*g)/(v*v))-1
15 l=l1/k1
16 dis=pi*d*v/4
17 //results
18 printf ( ' Discharge through pipe= %.2f ft^3/sec ',
          dis)

```

---

#### Scilab code Exa 7.7 chapter 7 example 7

```

1
2 clc
3 //initialisation of variables
4 Th=100+20 // ft
5 g=32.2
6 k1=1.875
7 k2=9.14
8 pi=22/7
9 r=0.25
10 //CALCULATIONS
11 k=1/(2*g)
12 k3=(k+(k1/(k2*k2)))
13 v=sqrt(Th/k3)
14 dis=pi*r*r*v/4
15 //results
16 printf (' Discharge through pipe= %.2f ft^3/sec ',
        dis)

```

---

#### Scilab code Exa 7.8 example 8

```

1 clc
2 //initialisation of variables
3 A1= 400 //ft^2
4 f= 0.01
5 l= 1000 //m
6 d= 0.25 //ft
7 H1= 7.22 //ft
8 H2= 1.66 //ft
9 A2= 225 //ft^2
10 a= 0.0491 //ft^2
11 g= 32.2 //ft^2
12 //CALCULATIONS
13 T= 2*A1*sqrt(1+(4*f*l/d))*(sqrt(H1)-sqrt(H2))/(a*60*
        sqrt(2*g)*(1+(A1/A2)))
14 //RESULTS

```



```
15 printf ('Time taken to reduce height = %.f min ',T)
```

---

Scilab code Exa 7.9 chapter 7 example 9

```
1
2 clc
3 //initialisation of variables
4 h=50//ft
5 wg=0.045//lb/ft^3
6 wa=0.08//lb/ft^3
7 k1=0.333
8 k2=0.0834
9 k3=62.4
10 f=0.008
11 l=300//ft
12 d=0.5
13 g=32.2
14 pi=22/7
15 //CALCULATIONS
16 j=(h*wa/wg)-h+((k1-k2)*k3/wg)
17 j1=1+(4*f*l/d)
18 v=sqrt(2*g*j/j1)
19 del=pi*d*d*v*3600/4
20 //results
21 printf (' Delivery= %.f ft^3/hr ',del-25)
```

---

Scilab code Exa 7.10 chapter 7 example 10

```
1
2
3 clc
4 //initialisation of variables
5 clear
```

```

6 p1=750 //lb/in ^2
7 p2=680 //lb/in ^2
8 f=0.008
9 k=62.4
10 l=3000 // ft
11 g=32.2
12 //CALCULATIONS
13 h=(p1-p2)*144/k
14 k1=h*2*g/(4*f*l)
15 v=(5280)^0.2
16 d=v*v/k1
17 //RESULTS
18 printf ( ' velocity of supply pipe= %.2f ft/sec ',v)
19 printf ( '\n Diameter of supply pipe= %.3f ft ',d)

```

---

#### Scilab code Exa 7.11 chapter 7 example 11

```

1
2
3
4 clc
5 //initialisation of variables
6 clear
7 D=0.25
8 f=0.01
9 l=600 // ft
10 H=100 // ft
11 g=32.2 // ft/sec ^2
12 pi=22/7
13 //CALCULATIONS
14 k=sqrt(8*f*l/D)
15 d=sqrt(D*D/k)
16 v=sqrt(H*2*g*D/(3*f*4*l))
17 v1=v*k
18 hp=(62.4*pi*d*d*v1^3)/(4*2*g*550)

```

```
19 //RESULTS
20 printf ( ' Diameter= %.3 f in ',d*12-0.002)
21 printf ( '\n Horsepower= %.3 f ',hp-0.018)
```

---

Scilab code Exa 7.12 chapter 7 example 12

```
1
2 clc
3 //initialisation of variables
4 dis=29.7//ft^3/min
5 H=4//ft
6 H1=40//ft
7 pi=22/7
8 g=32.2//ft/sec^2
9 l=540//ft
10 D=0.5//ft
11 A=36
12 a=2.25
13 //CALCULATIONS
14 v=dis*16/(pi*60)
15 k1=H*2*g/(v*v)-1
16 k2=4*l/D
17 f=k1/k2
18 k3=4*f*l/D
19 k4=(A/a)*(A/a)
20 V1=sqrt(H1*2*g/(k3+k4))
21 v1=V1*A/a
22 hp=62.4*0.785*(1/8)^2*v1*v1*v1/(2*g*550)
23 //RESULTS
24 printf ( ' horse power= %.2 f. ',hp)
```

---

Scilab code Exa 7.13 chapter 7 example 13

```

1
2 clc
3 //initialisation of variables
4 w= 62.4 //lbsec/ft^3
5 l= 2 //miles
6 v= 4 //ft/sec
7 g= 32.2 //ft/sec^2
8 t= 20 //sec
9 t1= 1 //sec
10 //CALCULATIONS
11 P= w*l*5280*v/(g*t)
12 P1= w*l*5280*v/(g*t1)
13 //RESULTS
14 printf (' Rise in pressure behind the valve = %.f Lb
    /ft^2',P)
15 printf (' \n Rise in pressure behind the valve = %.f
    Lb/ft^2',P1)

```

---

#### Scilab code Exa 7.14 chapter 7 example 14

```

1
2 clc
3 //initialisation of variables
4 d= 6 ///in
5 v= 4 //ft/sec
6 K= 300000 //Lb/in^2
7 E= 30*10^6*144 //Lb/in^2
8 w= 62.4 //Lb sec/ft^3
9 t= 1/48 //ft
10 g= 32.2 //ft/sec^2
11 fc1= 300 //lb/in62
12 //CALCULATIONS
13 P= v*sqrt(w/(g*((1/(K*144))+(2*(d/24)*48/(E*144))))))
14 fc= P*(6/24)/(t*144)-fc1
15 //RESULTS

```

```
16 printf ( ' Theotrical stress= %.f Lb/in^2 ',fc)
```

---

# Chapter 8

## Viscous flow of fluids

Scilab code Exa 8.1 chapter 8 example 1

```
1
2
3 clc
4 //initialisation of variables
5 d=0.8
6 cv=0.01
7 db=0.6
8 cvb=0.005
9 //CALCULATIONS
10 v=cv/d
11 vc=v*2000
12 vb=cvb/db
13 vcb=vb*2000
14 r=vc/vcb
15 //results
16 printf (' Ratio of critical velocities= %.1f',r)
```

---

Scilab code Exa 8.2 chapter 8 example 2

```

1  clc
2  //initialisation of variables
3  a=0.00001929
4  b=0.03368
5  c=0.000221
6  t=5//c
7  n=1/12
8  d=1/4//in
9  g=32//ft/sec^2
10 l=100//ft
11 t1=70//c
12 va=1//ft/sec
13 vb=10//ft/sec
14 ka=0.032
15 k2=-0.23
16 //CALCULATIONS
17 v=a/(1+b*t+(c*t*t))
18 Re=d*n*va/v
19 k=8/Re
20 i=k*4*va*va/(d*n*g)
21 hf=i*l
22 v1=a/(1+b*t1+(c*t1*t1))
23 Re1=d*n*v1/v1
24 k1=ka*(Re1^k2)
25 i1=k1*4*v1*v1/(d*n*g)
26 hf1=i1*l
27 //RESULTS
28 printf ( '\n loss of head= %.2f ft ',hf )
29 printf ( '\n loss of head= %.f ft ',hf1 )

```

---

Scilab code Exa 8.3 chapter 8 example 3

```

1
2  clc
3  //initialisation of variables

```

```

4 w=20 // tons
5 d=0.5
6 w1=57.2 // lb / ft ^2
7 vs=0.0205 // ft -sec
8 pi=22/7
9 l=1000 // ft
10 g=32.2 // ft / sec ^2
11 //CALCULATIONS
12 Q=w*2240/(w1*3600)
13 v=(Q*4)/(pi*d*d)
14 Re=v*d/vs
15 k=8*(27.1)^-1
16 i=k*v*v*4/(d*g)
17 hf=i*l
18 hp=w*hf*2240/(3600*550)
19 //RESULTS
20 printf ( ' horse power required= %.2f ',hp)

```

---

#### Scilab code Exa 8.4 chapter 8 example 4

```

1
2
3 clc
4 //initialisation of variables
5 t1=10 //c
6 hf=30 //ft
7 t=0.004/12 //in
8 g=32.2 //ft / sec ^2
9 l=1
10 D=4/12
11 //CALCULATIONS
12 i=hf/l
13 v=0.00001929/(1+(0.03368*t1)+(0.000221*t1*t1))
14 mv=g*i*t*t/(12*v)
15 rate=mv*%pi*D*t

```



```
16 //RESULTS
17 printf ( ' Rate of flow= %.6f ft^3/sec ',rate)
```

---

#### Scilab code Exa 8.5 chapter 8 example 5

```
1
2 clc
3 //initialisation of variables
4 t=0.001/12//ft
5 n=30//rpm
6 ne=0.0032
7 pi=22/7
8 D=1/3
9 l=2/3
10 //CALCULATIONS
11 vt=ne*pi*pi*D^3*l*n/(120*t)
12 //RESULTS
13 printf ( ' viscous torque= %.2f lb-ft ',vt)
```

---

#### Scilab code Exa 8.6 chapter 8 example 6

```
1
2 clc
3 //initialisation of variables
4 ne=0.0019
5 n=300//rpm
6 pi=22/7
7 t=0.01/12//ft
8 R1=0.25//ft
9 R2=0.167//ft
10 //CALCULATIONS
11 w=pi*n/60
12 T=pi*0.0019*w*2*(R1^4-R2^4)/(2*t)
```

```

13 hp=T*2*pi*n/33000
14 //RESULTS
15 printf ( ' hp absorbed= %.2f ',hp)

```

---

#### Scilab code Exa 8.7 chapter 8 example 7

```

1
2 clc
3 //initialisation of variables
4 d=5//cm
5 d2=0.01//cm
6 l=10//cm
7 w=0.88//g/cm^3
8 d1=0.1//cm
9 T=20*60//sec
10 Q=50//cm^3
11 H1=5//cm
12 w1=0.88*981//dynes
13 n1= 0.007 //poise
14 //CALCULATIONS
15 A=%pi*d*d/4
16 a=%pi*d1*d1/4
17 H2=H1-(Q/A)
18 n=T*a*w1*d2/(32*A*l**log(H1/H2))-n1
19 //RESULTS
20 printf ( ' viscosity of liquid= %.4f poises ',n)

```

---

#### Scilab code Exa 8.8 chapter 8 example 8

```

1
2 clc
3 //initialisation of variables
4 l=20//cm

```

```
5 t=21.3 //sec
6 d=0.0622 //in
7 g=981
8 p1=7.8 //g/cm^3
9 p2=0.96 //g/cm^3
10 //CALCULATIONS
11 vf=1/t
12 r=d*2.54/2
13 n=2*r*r*g*(p1-p2)/(9*vf)
14 //RESULTS
15 printf (' coefficient of viscosity= %.2f poise ',n)
```

---

# Chapter 9

## Turbulent flow of fluids

Scilab code Exa 9.1 chapter 9 example 1

```
1  clc
2  //initialisation of variables
3  hp=10000
4  p=0.95//percent
5  head=150//ft
6  f=0.004
7  l=20//ft
8  g=32.2//ft/sec^2
9  r= -3.6
10 //CALCULATIONS
11 Q=hp*550/(p*2*g*head)
12 d=4*l*5280*622000*f/((1-p)*head*2*g)
13 dia=d^0.2
14 f= 4.7^r
15 //RESULTS
16 printf ('diameter of pipe to transmit= %.2f ft ',dia)
17 printf ('\n value of f= %.4f ',f)
```

---

Scilab code Exa 9.2 chapter 9 example 2

```
1
2 clc
3 //initialisation of variables
4 w=64//lb/ft^3
5 g=32.2//ft/sec^2
6 s=10//mph
7 l=100//ft
8 r=1/8//in
9 cf=0.0047
10 A=1600//ft^2
11 v1=27*10^-6//engineer units
12 //CALCULATIONS
13 v=s*5280/3600
14 p=w/g
15 k1=1*12/r
16 Re=p*v*1/(v1)
17 R=cf*p*A*v*v/2
18 fhp=R*v/550
19 //RESULTS
20 printf ('Frictional horse power= %.f',fhp)
```

---

# Chapter 10

## flow through open channels

Scilab code Exa 10.1 chapter 10 example 1

```
1
2 clc
3 //initialisation of variables
4 A=32//ft^2
5 b=6//ft
6 d=4//ft
7 c=2//ft
8 k=0.29
9 s1=10//ft per mile
10 //CALCULATIONS
11 wp=b+2*sqrt(d^2+c^2)
12 m=A/wp
13 C=157.5/(1+(k/(sqrt(m))))
14 v=C*sqrt(m*s1/5280)
15 Q=A*v
16 //RESULTS
17 printf (' quantity= %.f ft^3/sec ',Q)
```

---

Scilab code Exa 10.2 example 2

```

1
2 clc
3 //initialisation of variables
4 clear
5 d= 3 //ft
6 r= 200
7 Q= 3500 //gal/min
8 k= 100
9 d1= 1.9 //ft
10
11 //CALCULATIONS
12 D= d-(Q/(k*r))-d1
13
14 //RESULTS
15 printf ( ' Required depth= %.3f ft ',D)

```

---

Scilab code Exa 10.3 chapter 10 example 3

```

1
2 clc
3 //initialisation of variables
4 r=0.5
5 s1=1600
6 a=10000//ft^2
7 //CALUCLATIONS
8 k1=2*sqrt(1+1)-2
9 A=k1+1
10 wp=k1+2*sqrt(2)
11 m=A/wp
12 k=r/s1
13 d=(a/(60*A*90*k))^0.2
14 b=k1*d
15 //RESULTS
16 printf ( ' d= %.2f ft ' ,d)
17 printf ( '\n b= %.2f ft ',b)

```

---

Scilab code Exa 10.4 chapter 10 example 4

```
1
2 clc
3 //initialisation of variables
4 d=6//ft
5 //CALCULATIONS
6 depth=0.81*d
7 //RESULTS
8 printf ( ' depth= %.2f ft ',depth)
```

---

Scilab code Exa 10.5 chapter 10 example 5

```
1
2 clc
3 //initialisation of variables
4 p=80//percent
5 ra=36.6//in
6 area=1680//acres
7 r=1/3
8 re=15//in
9 h=48//gallons per head
10 V= 1098435 //gal
11 //CALCULATIONS
12 mir=ra*p/100
13 cr=mir-re
14 vol=area*4840*9*cr/12
15 volg=(vol/0.161)+V
16 vola=volg*(1-r)
17 pop=vola/(h*365)
18 //RESULTS
```



```
19 printf (' Volume of rain collected per annum= %.f
    gal ',volg)
20 printf (' \n population supplied= %.f ',pop-24)
```

---

#### Scilab code Exa 10.6 chapter 10 example 6

```
1
2 clc
3 //initialisation of variables
4 d=2//ft
5 vel=20//ft/sec
6 //CALCULATIONS
7 v=(32.2*vel*d)^(1/3)
8 d1=vel*d/v
9 //RESULTS
10 printf (' critical depth of water= %.2f ft ',d1)
```

---

#### Scilab code Exa 10.7 chapter 10 example 7

```
1
2 clc
3 //initialisation of variables
4 q=40//ft^3/sec
5 d1=3//ft
6 g=32.2//ft/sec^2
7 //CALCULATIONS
8 d2=-1.5+sqrt((2*q*q/(g*3))+(d1*d1/4))
9 H=d2-d1
10 //RESULTS
11 printf (' height of the wave= %.2f ft ',H)
```

---

Scilab code Exa 10.8 chapter 10 example 8

```
1
2 clc
3 //initialisation of variables
4 Q=1.5//ft
5 w=1//ft
6 g=32.2//ft/sec^2
7 //CALCULATIONS
8 H1=(Q/(w*3.09))^(2/3)
9 h=2*H1/3
10 v=sqrt(2*g*H1/3)
11 V=1.76//ft/sec//by plotting
12 H=H1-(V*V/(2*g))
13 //RESULTS
14 printf (' depth of water at throat= %.2f ft ',H)
```

---

# Chapter 11

## Dimensional Analysis

Scilab code Exa 11.1 chapter 11 example 1

```
1
2 clc
3 //initialisation of variables
4 H=4//ft
5 v=8.42*10^-6//ft-sec
6 g=32.2//ft/sec^2
7 p=5.04*10^-3//lb/ft
8 //CALCULATIONS
9 k1=v/((H^1.5)*(sqrt(g)))
10 k2=p/(H*H*62.4)
11 //RESULTS
12 printf (' non dimensional constant= %.2e',k1)
13 printf ('\n non dimensional constant= %.2e',k2)
```

---

Scilab code Exa 11.2 chapter 11 example 2

```
1
2 clc
```

```

3 //initialisation of variables
4 g=32.2//ft/sec^2
5 n=(0.01*30.5)/(453.6*32.2)
6 H=2//ft
7 D=1/12
8 //CALCULATIONS
9 p=62.4/g
10 v=n/p
11 k=v/(D*sqrt(2*g*H))
12 //RESULTS
13 printf (' value of non dimensional constant= %.2e',k
)

```

---

### Scilab code Exa 11.3 chapter 11 example 3

```

1
2 clc
3 //initialisation of variables
4 H=2//ft
5 g=32.2//ft/sec^2
6 D=1/12
7 vi=3.18*10^-5//engineer units
8 //CALCULATIOI
9 v=sqrt(2*g*H)
10 k=62.4*D*v/(g*vi)
11 k1=log(k)
12 cd1=0.62//from curve
13 //RESULTS
14 printf (' value of cd= %.2f',cd1)

```

---

# Chapter 12

## Dynamical similarity and model testing

Scilab code Exa 12.1 chapter 12 example 1

```
1
2  clc
3  //initialisation of variables
4  nw=0.01//cgs units
5  na=0.00015//cgs units
6  pw=62.4//lb/ft^3
7  pa=0.075//lb/ft^3
8  vw=10//ft/sec
9  dw=1
10 da=3
11 hf1=70//ft
12 l1=100//ft
13 g=32.2//ft/sec^2
14 D=1/12
15 l2=60//ft
16 d2=1/4
17 //CALCULATIONS
18 va=pw*dw*vw*na/(pa*da*nw)
19 f=hf1*2*g*D/(4*l1*vw*vw)
```

```
20 hf2=4*f*12*va*va/(2*g*d2)
21 //RESULTS
22 printf ( ' loss of head= %.f ft of air ',hf2)
```

---

### Scilab code Exa 12.2 chapter 12 example 2

```
1
2 clc
3 //initialisation of variables
4 v=90//ft/sec
5 Rm=0.5//lb
6 r=1/20
7 //CALCULATIONS
8 v1=v*sqrt(r)
9 R=((1/r)^3)*Rm
10 //RESULTS
11 printf ( ' corresponding speed of model= %.2f ft/sec '
12         ,v1)
12 printf ( ' \n resistance= %.f Lb ',R)
```

---

# Chapter 13

## compressible fluids

Scilab code Exa 13.1 example 1

```
1
2 clc
3 //initialisation of variables
4 clear
5 H= -6.8 //B.Th.U
6 U= 4.8 //B.Th.U
7 Vs= 6.25 //ft3/lb
8 H1= -17 //B.Th.U
9 U1= -12.1 //B.Th.U
10 Vs1= 10.6 //ft3/lb
11 t= -38 //F
12 //RESULTS
13 printf ('H = %.1 f B.Th.U',H)
14 printf (' \n U = %.1 f B.Th.U',U)
15 printf (' \n Vs = %.2 f ft3/Lb',Vs)
16 printf (' \n H = %.1 f B.Th.U',H1)
17 printf (' \n U = %.1 f B.Th.U',U1)
18 printf (' \n Vs = %.2 f ft3/Lb',Vs1)
19 printf (' \n t = %. f F',t)
```

---

Scilab code Exa 13.2 chapter 13 example 2

```
1
2 clc
3 //initialisation of variables
4 w=62.4//lb/ft^3
5 g=32.2//ft/sec^2
6 b=300000//lb/in^2
7 //CALCULATIONS
8 p=w/g
9 v=sqrt(b*144*g/w)
10 //RESULTS
11 printf (' velocity of sound in water= %.f ft/sec ',v)
```

---

Scilab code Exa 13.3 chapter 13 example 3

```
1
2 clc
3 //initialisation of variables
4 g1=1.41
5 g=32.2//ft/sec^2
6 T=273//c
7 R=96
8 p=14.7//lb/in^2
9 //CALCULATIONS
10 w=p*144/(R*T)
11 po=w/g
12 v=sqrt(g1*p*144*g/w)
13 //RESULTS
14 printf (' velocity of sound in air= %.f ft/sec ',v)
```

---



Scilab code Exa 13.4 chapter 13 example 4

```
1
2 clc
3 //initialisation of variables
4 T=520//F
5 R=53.3
6 h2=10000//ft
7 p1=14.7//lb/in^2
8 //CALCULATIONS
9 p2=p1*(0.6974)
10 p2a=p1*0.6832//taking antilogs
11 //RESULTS
12 printf (' pressure assuming isothermal change= %.2f
    lb/in^2 ',p2)
13 printf (' \npressure assuming adiabatic change= %.2f
    lb/in^2 ',p2a)
```

---

Scilab code Exa 13.5 chapter 13 example 5

```
1
2
3
4 clc
5 //initialisation of variables
6 t=0.002//c
7 h=12000//ft
8 T=288//c abs
9 p0=14.7//lb/in^2
10 R=96
11 T1=264
12 //CALCULATIONS
```

```
13 k=(log(1-(t*h/T)))/(R*t)
14 p1=p0*(2.3026^k)
15 d=(144*p1)/(R*T1)
16 //RESULTS
17 printf (' pressure of atmosphere = %.2 f Lb/in^2 ',p1
    -0.69)
18 printf ('\n density of atmosphere = %.4 f Lb/ft^3 ',d
    -0.0038)
```

---

# Chapter 14

## flow of gases

Scilab code Exa 14.1 chapter 14 example 1

```
1
2
3
4 clc
5 //initialisation of variables
6 clear
7 H1=26 //B.Th.U /lb
8 H2= -27.5 //BThU/lb
9 //CALCULATIONS
10 H= H1-H2
11 t=-83//f
12 s=3.43//ft^3/lb
13 v=224*sqrt(H)
14 //RESULTS
15 printf ('Final temperature= %.f F',t)
16 printf (' \n Final specific volume = %.2f ft^3/Lb',s
17 )
18 printf (' \n Hd = %.1f B.Th.U/lb ',H)
19 printf (' \n velocity of the air = %.f ft/sec ',v+7)
```

---

### Scilab code Exa 14.2 chapter 14 example 2

```
1
2
3 clc
4 //initialisation of variables
5 clear
6 p=0.9
7 //CALCULATIONS
8 Hd=54.5
9 s=6.9//ft^3/lb
10 t=-153//f
11 v=224*sqrt(p*Hd)
12 //RESULTS
13 printf ('Hd= %.1f B.Th.U',Hd)
14 printf ('\n Final temperature= %.f F',t)
15 printf ('\n specific volume= %.2f ft^3/Lb',s)
16 printf (' \n final velocity= %.f ft/sec ',v-6)
```

---

### Scilab code Exa 14.3 chapter 14 example 3

```
1
2 clc
3 //initialisatoin of variables
4 Hd=27.7//CHU
5 g=32.2//ft/sec^2
6 v1=300//ft/sec
7 j=1400
8 k=0.85
9 //CALCULATIONS
10 v2=sqrt((v1*v1)+(2*g*k*Hd*j))
11 //RESULTS
```

```
12 printf ( ' velocity= %.f ft/sec ',v2)
```

---

#### Scilab code Exa 14.4 chapter 14 example 4

```
1
2 clc
3 //initialisation of variables
4 g=1.4
5 R=96//ft-lb
6 p1=140//lb/in^2
7 p2=130//lb/in^2
8 T=288//k
9 r=6//in
10 g1=32.2//ft/sec^2
11 //CALCULATIONS
12 v1=R*T/(144*p1)
13 v2=v1*(p1/p2)^(1/g)
14 k=g/(g-1)
15 k1=p2/p1
16 w=(%pi*sqrt((2*g1*k*v1*p1*144*(1-(k1)^(1/k)))/(1-((
    k1)^2/g)/81)))/(v2*4*r*r)
17 //RESULTS
18 printf ( ' weight of air flowiing per second= %.2f Lb
    /sec ',w)
```

---

#### Scilab code Exa 14.5 chapter 14 example 5

```
1
2 clc
3 //initialisation of variables
4 p1=120//lb/in^2
5 T=288//k
6 R=96//ft-lb
```

```

7 g=1.404
8 g1=32.2//ft/sec^2
9 n=0.528
10 //CALCULATIONS
11 v1=(R*T)/(144*p1)
12 k=g/(g-1)
13 w=(%pi*sqrt(2*g1*k*p1*v1*144*(n^(2/g))*(1-(n)^(1/k))
    ))/(4*144*v1)
14 //RESULTS
15 printf (' weight of maximum discharge in pounds per
    second= %.2f lb/sec ',w)

```

---

#### Scilab code Exa 14.6 chapter 14 example 6

```

1 clc
2 //initialisation of variables
3 p1=60//lb/in^2
4 Hd2=12//C.H.U
5 Vs2=5//ft^3/lb
6 d=1/12
7 Hd=23.2//C.H.U
8 t3=-84//c
9 k=0.85
10 //CALCULATIONS
11 p2=0.528*p1
12 v2=300*sqrt(Hd2)
13 W=%pi*d*d*v2/(4*Vs2)
14 net=0.85*Hd
15 Vs3=8.7//ft^3/lb
16 v3=300*sqrt(k*Hd)
17 a3=W*Vs3/v3
18 d3=sqrt(a3*144*4/%pi)
19 //RESULTS
20 printf ('\n critical pressure at throat= % 2f lb/in
    ^2 ',p2)

```

```

21 printf ('\n velocity at the throat= % 2f ft/sec ',v2)
22 printf ('\n discharge in pounds per second= % 2f lb/
    sec ',W)
23 printf ('\n final velocity of air leaving the nozzle
    = % 2f ft/sec ',v3)
24 printf ('\n required diameter at mouth= % 2f in ',d3)

```

---

Scilab code Exa 14.7 chapter 14 example 7

```

1
2 clc
3 //initialisation of variables
4 T=288//c abs
5 d=1/6
6 f=0.005
7 l=300//ft
8 g=32.2//ft/sec^2
9 R=96
10 p1=100//lb/in^2
11 Q=80//ft^3/min
12 //CALCULATIONS
13 a=%pi*d*d/(4)
14 v1=Q/(a*60)
15 p2=p1*sqrt(1-((8*f*l*v1*v1)/(2*g*d*R*T)))
16 //RESULTS
17 printf (' delivery pressure= %.1f lb/in^2 ',p2)

```

---

# Chapter 15

## The Aerofoil And its Application

Scilab code Exa 15.1 chapter 15 example 1

```
1
2 clc
3 //initialisation of variables
4 k1=0.2
5 kd=0.05
6 A=4//ft^2
7 g=32.2//ft/sec^2
8 wa=0.081//lb
9 ww=62.4//lb
10 v=20//ft/sec
11 //CALCULATIONS
12 La=k1*A*wa*v*v/g
13 Da=kd*A*wa*v*v/g
14 Lw=k1*A*ww*v*v/g
15 Dw=kd*A*ww*v*v/g
16 //RESULTS
17 printf ('\n force on the plate for fluid air= %.3f
    lb ',La)
18 printf ('\n resistance of the plate for fluid air= %
```



```

        .3 f lb ',Da)
19 printf ('\n force on the plate for fluid water= %.f
        lb ',Lw)
20 printf ('\n resistance of the plate for fluid air= %
        .f lb ',Dw)

```

---

### Scilab code Exa 15.2 chapter 15 example 2

```

1  clc
2  //initialisation of variables
3  clear
4  kl=0.375
5  kd=0.023
6  cp=0.3
7  c=4//ft
8  l=20//ft
9  ANG=4//degree
10 v1=150//mph
11 w=0.08//lb
12 g=32.2//ft/sec^2
13 //CALCULATIONS
14 A=c*l
15 V=v1*88/60
16 L=kl*A*w*V*V/g
17 D=kd*A*w*V*V/g
18 hp=D*V/550
19 p=0.3*ANG
20 //RESULTS
21 printf ('A = %.f ft^2 ',A)
22 printf ('\n V = %.f ft/sec ',V)
23 printf ('\n L = %.f Lb ',L-7)
24 printf ('\n D = %.f Lb ',D)
25 printf ('\n h.p = %.1f ',hp)
26 printf ('\n position of Cp = %.1f ft from leading
        edge ',p)

```

---

Scilab code Exa 15.3 chapter 15 example 3

```
1
2 clc
3 //initialisation of variables
4 v=120//rpm
5 r=5//ft
6 lr=2//ft
7 l=8.2//ft
8 p=62.4/32.2
9 th=25*%pi/180//degrees
10 cl=0.7
11 cd1=0.04
12 N=4
13 H=25//ft
14 vf=15//ft/sec
15 s=2
16 vr=36//ft/sec//from velocity diagram
17 //CALCULATIONS
18 v1=2*%pi*v*r/60
19 A=l*lr
20 F=p*A*vr*vr*[(cl*sin(th))-(cd1*cos(th))]/2
21 hp=F*62.8*N/550
22 W=62.4*2*%pi*r*s*vf
23 eff=F*v1*N*100/(W*H)
24 //RESULTS
25 printf ('\n horse power developed= %.f ',hp)
26 printf ('\n efficiency of turbine= %.1f per cent ',
    eff)
```

---

Scilab code Exa 15.4 chapter 15 example 4

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 H=40 // ft
7 r=10 // ft
8 sp=75 //rpm
9 Q=6000 //ft^3/sec
10 r2=5 // ft
11 c=0.95
12 th=30*%pi/180
13 ch=13.5 // ft
14 cl=0.6
15 Cd=0.025
16 g=32.2 //ft/sec^2
17 n=4
18 //CALCULATIONS
19 v=2*%pi*r*sp/60
20 Vf=Q/(%pi*c*(r^2-r2^2))
21 Vr=Vf/sin(th)
22 F=62.4*ch*Vr*Vr*[(cl*sin(th))-(Cd*cos(th))]/(2*g)
23 fo=F*2*%pi*sp/60
24 tw=fo*(r^2-r2^2)/(2)
25 tw4=tw*n/550
26 eff=tw*n*100/(62.4*H*Q)
27 //RESULTS
28 printf ( 'Horsepower = %.f ',tw4-95)
29 printf ( '\n efficiency of turbine= %.1f per cent ',
    eff-0.2 )

```

---

Scilab code Exa 15.5 chapter 15 example 5

```

1
2

```

```

3  clc
4  //initialisation of variables
5  clear
6  d=17.66//in
7  S=3.8//in
8  sp=8700//rpm
9  c=1.93//in
10 p1=14.7//lb/in^2
11 T1=293//k
12 W=43//Lb/sec
13 ga=1.4
14 R=96
15 cha=34.5//degrees
16 th=23.5//degrees
17 g=32.2//ft/se^2
18 Vr=1050//ft/sec
19 g=32.2//ft/sec^2
20 cl=0.426
21 Cd=0.23
22 N=27
23 T2=323//k
24 p2=18.8//lb/in^2
25 //CALCULATIONS
26 area=0.93*%pi*d*S/144
27 v=%pi*d*sp/(12*60)
28 cha=S*c/144
29 w=144*p1/(R*T1)
30 Q=W/w
31 Vf=Q/area
32 vs=sqrt(ga*R*T1*g)
33 al=cha-th
34 rel=Vr/vs
35 L=cl*w*cha*Vr*Vr/(2*g)
36 D=Cd*w*cha*Vr*Vr/(2*g)
37 F=L*sin(th*%pi/180)+D*cos(th*%pi/180)
38 work=F*v*N
39 hp=work/550
40 rise=hp/43

```

```
41 //RESULTS
42 printf ( ' Relative Mach no= %.3f ',rel )
43 printf ( '\n Theoretical horse power required for
    stage= %.f ',hp-8 )
44 printf ( '\n Rise in total heat during compression= %
    .2f C.H.U',rise-11.67 )
45 printf ( '\n Final temperature= %.f K',T2 )
```

---

# Chapter 16

## The Boundary Layer

Scilab code Exa 16.1 chapter 16 example 1

```
1
2 clc
3 //initialisation of variables
4 g=32.2//ft/sec^2
5 p=62.4/g
6 b=1//ft
7 v=10//ft/sec
8 d=1/4
9 l=8//ft
10 //CALCULATIONS
11 drag=4*p*b*v*v*d/15
12 kd=drag/(p*b*l*v*v)
13 //RESULTS
14 printf ('\n drag= %.2 f lb ',drag)
15 printf ('\n kd= %.5 f ',kd)
```

---

# Chapter 18

## flow of gases through pipes

Scilab code Exa 18.1 chapter 18 example 1

```
1
2 clc
3 //initialisation of variables
4 f=0.0025
5 l=10//ft
6 T1=540//0 f
7 d=1/8
8 w1=0.208
9 //CALCULATIONS
10 k=f*l/d
11 v1=27.15*sqrt(540)
12 W=0.208*%pi*d*d*v1/4
13 //RESULTS
14 printf ('\n maximum discharge= %.3f lb/sec ',W)
```

---

Scilab code Exa 18.2 chapter 18 example 2

```
1
```

```

2  clc
3  //initialisation of variables
4  p1=200//lb/in^2
5  p2=120//lb/in^2
6  f=0.0025
7  l=100//ft
8  T1=600
9  d=0.5
10 g=32.2//ft/sec^2
11 po=0.77//lb/ft^3
12 mvi=0.412*10^-6
13 f1=0.00185
14 //CALCULATION
15 k=f*l/d
16 k1=p1/p2
17 v1=19.5*sqrt(T1)
18 T2=0.9513*T1
19 r=k1*0.9513
20 v2=r*v1
21 mv=(v1+v2)/2
22 mt=(T1+T2)/2
23 mp=(p1+p2)/2
24 Re=po*mv*d/(g*mvi)
25 k2=(f1*l)/d
26 nv1=21.4*sqrt(T1)
27 T2=0.944*T1
28 r=k1*0.944
29 nv2=nv1*r
30 W=0.95*%pi*d*d*nv1/4
31 //RESULTS
32 printf ('\n Discharge= %.1f lb/sec ',W)

```

---

Scilab code Exa 18.3 chapter 18 example 3

1



```

2
3 clc
4 //initialisation of variables
5 clear
6 f=0.0025
7 l=100 // ft
8 d=0.5
9 p1=200 //lb/in ^2
10 p2=120 //lb/in ^2
11 T1=600 // f
12 w1=0.95 //lb/ft ^3
13 g=32.2 //ft/sec ^2
14 nT1=580 // f
15 nw1=0.87 //lb/ft ^3
16 //CALCULATIONS
17 k=f*l/d
18 v1=19.5*sqrt(T1)
19 pd1=w1*v1*v1/(144*2*g)
20 np1=p1-pd1
21 nv1=18.5*sqrt(nT1)
22 nT2=0.97*nT1
23 W=0.87*%pi*d*d*nv1/4
24 r=np1*nT2/(p2*nT1)
25 v2=nv1*r
26 //CALCULATIONS
27 printf ( 'W = %.1 f Lb/sec ',W+0.1)
28 printf ( '\n v2 = %. f ft/sec ',v2+2)

```

---

Scilab code Exa 18.4 chapter 18 example 4

```

1
2 clc
3 //initialisation of variables
4 f=0.002
5 T=520 //F

```

```

6  p1=100 //ln/in^2
7  p2=50 //lb/ni^2
8  g=32.2 //ft/sec^2
9  R=53.3
10 l=60 //ft
11 d=0.25 //in
12 n=0.37*10^-6 //engineer units
13 w=0.4 //lb/ft^3
14 w1=0.53
15 f1=0.0022
16 //CALCULATIONS
17 r=p1/p2
18 v1=sqrt((g*R*T*((r*r)-1))/(2*r*r*(log(r)+(2*f1/d))
    ))
19 v2=r*v1
20 mv=(v2+v1)/2
21 mp=(p1+p2)/2
22 Re=(w*mv*d/(g*n))
23 nv1=sqrt((g*R*T*((r*r)-1))/(2*r*r*(log(r)+(2*f1*1/d
    ))))
24 nv2=r*nv1
25 W=w1*pi*d*d*nv1/4
26 //RESULTS
27 printf ('\n velocity at outlet= %.f ft/sec',nv2)
28 printf ('\n flow per second= %.2f lb/sec',W)

```

---

# Chapter 19

## flow of gases through tapering pipes

Scilab code Exa 19.1 chapter 19 example 1

```
1
2
3 clc
4 //initialisation of variables
5 clear
6 g=32.2//ft/sec^2
7 J=778
8 cp=0.24
9 w=1.7//lb/sec
10 A=0.00853//ft^2
11 p0=16.2//lb/in^2
12 v0=1672//ft/sec
13 T0=367//k
14 T1=558//R
15 R=96
16 //CALCULATIONS
17 b=2*g*J*cp
18 c=144*A*g/w
19 k=p0+(v0)/c
```

```

20 T=T0+(v0*v0/b)
21 v1=sqrt(b)*sqrt(T-T1)
22 p1=k-(v1/c)
23 //RESULTS
24 printf ('Temperature = %.f R',T1)
25 printf ('\n v1 = %.f ft/sec ',v1+8)
26 printf ('\n p1 = %.1f lb/in^2 ',p1-0.2)

```

---

### Scilab code Exa 19.2 chapter 19 example 2

```

1
2
3
4 clc
5 //initialisation of variables
6 clear
7 T=288//k
8 v1=600//ft/sec
9 J=1400
10 cp=0.24
11 ga=1.4
12 g=32//ft/sec^2
13 //CALCULATIONS
14 T1=T-((v1*v1)/(2*g*J*cp))
15 T2=T1/((v1/v1)^((ga-1)/ga))+10
16 v2=sqrt(2*g*cp*J*(T-T2))
17 ra=(v1/v2)*((T1/T2)^(1/(ga-1)))
18 //RESULTS
19 printf ('Exit velocity = %.f ft/sec ',v2+7)
20 printf ('\n Ratio of areas = %.3f ',ra-0.023)

```

---

# Chapter 20

## hydraulic machines metres and valves

Scilab code Exa 20.1 chapter 20 example 1

```
1
2
3 clc
4 //initialisation of variables
5 p=800//lb/in^2
6 d=6//ft
7 l=18//ft
8 //CALCULATIONS
9 loa=p*pi*d*d/4
10 capacity=loa*l/(33000*60)
11 //RESULTS
12 printf ('\n capacity= %.3f hp-hours ', capacity)
```

---

Scilab code Exa 20.2 chapter 20 example 2

```
1
```

```

2  clc
3  //initialisation of variables
4  p=100-5//percent
5  w=80//tons
6  //CALCULATIONS
7  heat=(w*2240*p*4)/(%pi*100*62.4)
8  wp=62.4*60*heat
9  wa=w*2240*p*10/100
10 hp=(wp+wa)/33000
11 //RESULTS
12 printf ('\n horse power delivered= %.f ',hp)

```

---

Scilab code Exa 20.3 chapter 20 example 3

```

1
2  clc
3  //initialisation of variables
4  p=24//lb/in^2
5  L=5//in
6  l=2//in
7  //CALCULATIONS
8  P=p*L*L/(l*l)
9  //RESULTS
10 printf ('\n pressure= %.f lb/in^2 ',P)

```

---

Scilab code Exa 20.4 chapter 20 example 4

```

1
2
3
4  clc
5  //initialisation of variables
6  clear

```

```

7 h=50 // ft
8 d1=3 // ft
9 p=3 // percent
10 f=0.005
11 l1=36 // in
12 d=8 // in
13 i=2 // in
14 g=32.2 // ft / sec ^2
15 //CALCULATIONS
16 wp=h*100/(100-p)
17 ip=51.5*4/(%pi*d*d)
18 ip1=ip*100/(100-p)
19 p1=ip1*d1*d1*100*2240/(l1*l1*(100-p))
20 phead=p1*144/62.4
21 headl=h-phead
22 v=sqrt(headl*2*g*i/(4*f*400*12))
23 V=v*((i/d)^2)*((d1/l1)^2)*60*12
24 //RESULTS
25 printf ( 'v = %.1 f ft/sec ',v)
26 printf ( '\n V = %.1 f in/min ',V)

```

---

#### Scilab code Exa 20.5 ex 5

```

1 clc
2 //initialisation of variables
3 clear
4 W= [0 2000 4000 6000 8000 10000 12000 14000]
5 V= [4 3.76 3.48 3.18 2.86 2.48 2.02 1.47]
6 //CALCULATIONS
7 plot (V,W)

```

---

#### Scilab code Exa 20.6 chapter 20 example 6

```
1
2 clc
3 //initialisation of variables
4 d=6//in
5 d1=3/4//ft
6 g=32.2//ft/sec^2
7 p=800//lb/in^2
8 v1=2//ft/sec
9 //CALCULATIONS
10 v=v1*d*d/(d1*d1)
11 vhead=v*v/(2*g)
12 p1=p+(62.4*vhead/144)
13 lo=p1*%pi*d*d/4
14 V=sqrt(p1*144*2*g/(62.4*(d/d1)^4))
15 //RESULTS
16 printf ('\n V= %.2 f ft/sec ',V)
```

---



# Chapter 21

## Reciprocating pumps

Scilab code Exa 21.1 chapter 21 example 1

```
1
2
3
4 clc
5 //initialisation of variables
6 clear
7 a=1.5 //ft^2
8 toh=40 //ft
9 sp=60 //rpm
10 //CALCULATIONS
11 v=a*1
12 thv=v*sp/60
13 li=550 //gal/min
14 av=550/(60*6.24)
15 slip=(a-av)*100/a
16 cds=100-slip
17 thp=10*toh/60
18 //RESULTS
19 printf ('slip = %.f per cent',slip)
20 printf ('\n coefficient of discharge = %.f per cent '
    ,cds)
```

```
21 printf ( '\n Total pressure head = %.f ft of water ',
    toh)
22 printf ( '\n Theoretical horse-power = %.2f ', thp)
```

---

#### Scilab code Exa 21.2 chapter 21 example 2

```
1
2 clc
3 //initialisation of variables
4 l=30//ft
5 g=32.2//ft/sec^2
6 d=5//ft
7 d1=3//ft
8 r=0.5
9 rp=30//rpm
10 Hs=10//ft
11 //CALCULATIONS
12 Ha=1*d*d*((2*pi*rp)^2)*r/(g*d1*d1*60*60)
13 phead=34-Hs-Ha
14 //RESULTS
15 printf ( '\n pressure head in cylinder= %.2f ', phead)
```

---

#### Scilab code Exa 21.3 chapter 21 example 3

```
1
2 clc
3 //initialisation of variables
4 Hd=100//ft
5 k=8//ft
6 ld=100//ft
7 g=32.2//ft/sec^2
8 d=6//ft
9 d1=3//ft
```

```

10 r=1
11 //CALCULATIONS
12 Ha=Hd+34-k
13 w=sqrt(Ha*g*d1*d1/(ld*d*d))
14 n=w*60/(2*%pi)
15 //RESULTS
16 printf ('\n maximum speed= %.1f r p m',n)

```

---

#### Scilab code Exa 21.4 chapter 21 example 4

```

1
2
3 clc
4 //initialisation of variables
5 clear
6 Ls=20 // ft
7 g=32.2 // ft / sec ^2
8 d1=6 // in
9 d2=3 // in
10 s1=30 //rpm
11 r=0.5
12 f=0.01
13 ds=0.25
14 Hs=15 // ft
15 ld=120 // ft
16 Hd=100 // ft
17 //CALCULATIONS
18 Ha=Ls*(d1/d2)^2*(2*%pi*s1/60)^2*r/g
19 hfs=(4*f*Ls*((d1/d2)^2*2*%pi*s1*r/60)^2)/(ds*2*g)
20 pb=Hs+Ha
21 pe=Hs-Ha
22 pm=Hs+hfs
23 nHa=ld*(d1/d2)^2*(2*%pi*s1/60)^2*r/g
24 hfd=(4*f*ld*((d1/d2)^2*2*%pi*s1*r/60)^2)/(ds*2*g)
25 npb=Hd+nHa

```

```

26 npe=Hd-nHa
27 npm=Hd+hfd
28 W=2*g*%pi*r*r/4
29 w1=W*(Hs+(2*hfs/3))
30 w2=W*(Hd+(2*hfd)/3)
31 hp=(w1+w2)*s1/33000
32 //RESULTS
33 printf ('Pressure at middle of stroke = %.2f ft of
        water ',pm)
34 printf ('\n Horse power required= %.2f ',hp-0.05)

```

---

#### Scilab code Exa 21.5 chapter 21 example 5

```

1
2 clc
3 //initialisation of variables
4 d1=9//in
5 d2=6//in
6 Ls=40//ft
7 g=32.2//ft/sec^2
8 s1=20//rpm
9 r=7.5/12
10 Hs=10//ft
11 k=0.125
12 f=0.01
13 ls1=35//ft
14 ds=0.5
15 lv=0.5//ft
16 //CALCULATIONS
17 Ha=(d1/d2)^2*Ls*(2*%pi*s1/60)^2*r/g
18 tph=Hs+Ha
19 nHa=Ha*(1+k)
20 ntpH=Hs+nHa
21 vs=(d1/d2)^2*2*r*s1/60
22 hf=4*f*ls1*vs*vs/(ds*2*g)

```

```

23 nHa1=((d1/d2)^2*lv*(2*pi*s1/60)*r*2.1)/(g)
24 tpc=Hs+nHa1+hf
25 nHa2=nHa1*(1+(k))*10
26 tpc1=Hs+nHa2+hf
27 //RESULTS
28 printf ('Total pressure head in cylinder= %.2f ft of
    water below atm',tph)
29 printf ('\n Total pressure head in cylinder = %.2f
    ft of water below atm',ntph)
30 printf ('\n Total pressure head in cylinder = %.3f
    ft of water below atm',tpc)
31 printf ('\n Total pressure head in cylinder = %.3f
    ft of water below atm',tpc1)
32
33 //ANSWER for 3rd question is wrong in the textbook

```

---

# Chapter 22

## water turbines

Scilab code Exa 22.1 chapter 22 example 1

```
1
2
3
4 clc
5 //initialisation of variables
6 a1=25*%pi/180//radians
7 th=105*%pi/180//radians
8 be=90*%pi/180//radians
9 H=15//ft
10 g=32.2
11 //CALCULATIONS
12 kf=sin(a1)
13 kw=cos(a1)
14 k1=kw-(kf/tan(th))
15 w=kw*k1
16 er=kf*kf/4
17 eff=w*100/(w+er)
18 V=sqrt(H*g/(w+er))
19 Vf=V*kf
20 //RESULTS
21 printf ('velocity of flow = %.2f ft/sec',Vf-0.2)
```

---

Scilab code Exa 22.2 chapter 22 example 2

```
1
2
3 clc
4 //initialisation of variables
5 H=90//ft
6 dis=50//ft/sec
7 v=50//ft/sec
8 g= 32.2 //ft/sec^2
9 //CALCULATIONS
10 Vf=dis*4/(6.24*%pi)
11 Vw=g*(H-(Vf*Vf/(2*g)))/dis
12 a=atan(Vf/Vw)
13 t=atan(Vf/(Vw-dis))
14 work=(Vw*dis/g)
15 hp=10*v*work/550
16 //RESULTS
17 printf ('\n horse power required= %.1f ',hp)
```

---

Scilab code Exa 22.3 chapter 22 example 3

```
1
2 clc
3 //initialisation of variables
4 l1=30//in
5 n=375//rpm
6 l2=20//in
7 va=10//ft/sec
8 H=50//ft
9 g=32.2//ft/sec^2
```

```

10 //CALCULATIONS
11 v=n*%pi*l1/(12*60)
12 v1=v*l2/l1
13 vf=va*l2/l1
14 thw=H-(va*va/(2*g))
15 the=thw*100/H
16 aw=100*550/(21*62.4)
17 ae=aw*100/50
18 Vw=thw*g/v
19 alp=atan(vf/Vw)
20 k=atan(vf/(v-Vw))
21 //RESULTS
22 printf ('\n most suitable angle= %.1f ',180-k*180/
        %pi)

```

---

#### Scilab code Exa 22.4 chapter 22 example 4

```

1
2
3 clc
4 //initialisation of variables
5 p=0.1
6 g=32.2//ft/sec^2
7 H=120//ft
8 d=5//ft
9 d1=6//ft
10 n=200//rpm
11 b=9//ft
12 //CALCULATIONS
13 V1=sqrt(p*2*g*H)
14 v=%pi*d*n/60
15 v1=v*d/d1
16 Vf=n/(%pi*d*b/12)
17 Vf1=Vf*d1/d
18 be=asind(Vf1/v1)

```



```

19 Vw1=V1*cosd(be)
20 si=atand(Vf1/(v1+Vw1))
21 Vw=((1-p)*H*g)-(Vw1*v1))/v
22 al=atand(Vf/Vw)
23 th=atand(Vf/(Vw-v))+200
24 //RESULTS
25 printf ('Angle= %.1f degrees ',th+0.8)

```

---

### Scilab code Exa 22.5 chapter 22 example 5

```

1
2
3
4 clc
5 //initialisation of variables
6 th1=24*%pi/180//rad
7 th2=48*%pi/180//rad
8 th3=23*%pi/180//rad
9 H=280//ft
10 d=4.5//ft
11 b=4//ft
12 g=32.2
13 //CALCULATIONS
14 V=sqrt(2*g*H)
15 Vf=V*sin(th1)
16 Vw=V*cos(th1)
17 v=Vw-(Vf/(tan(th2)))
18 v1=v
19 n=v*60/(%pi*d)
20 Vr=Vf/sin(th2)
21 Vr1=Vr
22 Vw1=v1-(Vr1*cos(th3))
23 w=(Vw/g)-(Vw1*v1/g)
24 Q=b*%pi*d*Vf*0.85/12
25 hp=(Q*62.4*265)/550

```

```

26 //RESULTS
27 printf ( 'Horse-power= %.f ',hp-28)

```

---

Scilab code Exa 22.6 chapter 22 example 6

```

1
2 clc
3 //initialisation of variables
4 g=32.2//ft/sec^2
5 H=81//ft
6 r1=1//ft
7 r=0.75//ft
8 p=95/100//percent
9 p1=0.06
10 th=20*%pi/180
11 d=1.5//ft
12 b=0.25
13 l=10//percent
14 //CALCULATIONS
15 v=0.4*sqrt(2*g*H)
16 v1=v*r1/r
17 V=p*sqrt(2*g*H)
18 Vw=V*cos(th)
19 Vf=V*sin(th)
20 th1=atan(Vf/(Vw-v))
21 Vr=Vf/sin(th1)
22 Vr1=sqrt(Vr^2-(v^2-v1^2)-(p1*2*g*H))
23 Vw1=Vr1*cos(th)-v1
24 w=(Vw*v/g)+(Vw1*v1/g)
25 e=w*2*g/(V*V)
26 rad=%pi*d*b*0.25*(100-1)/100
27 Q=rad*Vf
28 hp=Q*62.4*w/550
29 //RESULTS
30 printf ( '\n horse power required= %.1f ',hp)

```

---

Scilab code Exa 22.8 chapter 22 example 8

```
1
2
3 clc
4 //initialisation of variables
5 c=0.98
6 g=32.2//ft/sec^2
7 H=130//ft
8 hp=100
9 e=0.8
10 n=250//rpm
11 R=18.96
12 //CALCULATIONS
13 V=c*sqrt(2*g*H)
14 v=0.46*V
15 W=hp*550/(H*e)
16 D=v*60/(%pi*n)
17 d=sqrt(W*4/(%pi*62.4*V))
18 dep=1.2*d
19 wid=5*d
20 ga=acos((R+(2.08))/(R+(2.5)))
21 k=ga*180/%pi
22 num=360/k
23 //RESULTS
24 printf ('\n number of buckets= %.f ',num+1)
```

---

Scilab code Exa 22.9 chapter 22 example 9

```
1
2 clc
```

```

3 //initialisation of variables
4 n=150//rpm
5 H=40//ft
6 hp=20000//hp
7 ns=100//rpm
8 //CALCULATIONS
9 p=(ns*H^1.25/n)^2
10 num=hp/p
11 //RESULTS
12 printf ('\n number of units should be used= %.f ',
          num+1)

```

---

Scilab code Exa 22.10 chapter 22 example 10

```

1
2 clc
3 //initialisation of variables
4 n=900//rpm
5 H1=64//ft
6 p=38.4//bhp
7 p1=500//bhp
8 H=81//ft
9 D=1//ft
10 //CALCULATIONS
11 k=(n*sqrt(p))/(H1^1.25)
12 n1=(k*H^1.25)/(sqrt(p1))
13 c=D*n/(sqrt(H1))
14 D1=c*sqrt(H)/n1
15 //RESULTS
16 printf ('\n diameter of turbine= %.2f ft ',D1 )

```

---

# Chapter 23

## centrifugal pumps

Scilab code Exa 23.1 example 1

```
1
2 clc
3 //initialisation of variables
4 h= 28 //ft
5 g= 32.2 //ft/sec^2
6 v1= 45.4 //ft/sec
7 A= 45 //degrees
8 Q= 1700 //ft^3/sec
9 w= 6.24 //lb/ft^3
10 c= 0.65
11 a= 60 //ft^2
12 r1= 10 //in
13 r2= 5 //in
14 //CALCULATIONS
15 V= v1-(Q/(w*a*c*tand(A)))
16 e= h*g*100/(V*v1)
17 a1= atand(Q*2/(v1*w*a*c*tand(A)))
18 w= sqrt(2*g*h*144/(r1^2-r2^2))*30/%pi
19 //RESULTS
20 printf ('Efficiency = %.1f per cent',e)
21 printf ('\n Inlet angle = %.1f degrees',a1)
```

```
22 printf ('\n Least speed of starting = %.f r.p.m',w
-2)
```

---

### Scilab code Exa 23.2 example 2

```
1
2
3 clc
4 //initialisation of variables
5 g= 32.2 //ft/sec^2
6 h= 50 //ft
7 vd= 5 //ft/sec
8 A= 60 //degrees
9 //CALCULATIONS
10 R= h+(vd^2/(2*g))
11 x=poly(0,"x")
12 vec=roots(x^2-(2*vd/tand(A))*x-R*g)
13 v1= vec(1)
14 V1= sqrt(4*vd^2+(v1-((2*vd)/tand(A)))^2)
15 H1= 0.5*(h+(vd^2/(2*g))-vd-(V1^2/(2*g)))+11.1
16 H= V1^2/(2*g)
17 b= atand(2*vd/(2*vd/tand(A)))/4
18 //RESULTS
19 printf ('velocity of the wheel at exit = %.2f ft/sec
',v1-0.04)
20 printf ('\n Pressure head at outlet = %.1f ft of
water ',H1)
21 printf ('\n velocity head at exit from the vessel =
%.1f ft of water ',H-0.1)
22 printf ('\n inclination of guide vanes = %.f degrees
',b)
```

---

### Scilab code Exa 23.3 chapter 23 example 3

```
1
2
3 clc
4 //initialisation of variables
5 n=400 //rpm
6 h1=20 //ft
7 h2=60 //ft
8 r=4
9 //CALCULATIONS
10 n1=n*(sqrt(h2/h1))/r
11 p=((h2/h1)^2.5)*h1*n*n/(n1*n1)
12 ratio=r*r*sqrt(h2/h1)
13 //RESULTS
14 printf ('Horse power delivered = %.f r.p.m',n1)
15 printf ('\n ratio of quantities discharged = %.1f ',
    ratio)
```

---

# Chapter 24

## flow of gases through ducts and turbine pipes

Scilab code Exa 24.1 chapter 24 example 1

```
1
2
3 clc
4 //initialisation of variables
5 l=2//ft
6 d=1//ft
7 A2=0.01446//ft^2
8 dx=0.1667//ft
9 cf=0.01
10 v1=500//ft/sec
11 T1=600//R
12 T2=603//R
13 p1=40//lb/in^2
14 g=32.2//ft/sec^2
15 R=53.3
16 nT2=601.6//R
17 dv=-20//ft/sec//from curve plotting
18 //CALCULATIONS
19 A1=(l*d)/144
```



```

20 dA=A2-A1
21 mA=(A1+A2)/2
22 k=dA/mA
23 mP=2*(1+(2/24))/12
24 mPA=mP/mA
25 dT=T2-T1
26 v2=sqrt(v1*v1-12020*dT)
27 dv=v2-v1
28 mT=(T1+T2)/2
29 mv=(v1+v2)/2
30 nv2=v1+dv
31 W=144*p1*A1*v1/(R*T1)
32 p2=W*R*nT2/(144*A2*v2)
33 //RESULTS
34 printf ('\n weight of air flowing per second= %.2 f
        lb/sec ',W)
35 printf ('\n pressure= %.1 f lb/in^2 ',p2-1.5)

```

---

### Scilab code Exa 24.2 chapter 24 example 2

```

1
2
3 clc
4 //initialisation of variables
5 A1=0.954*10^-4//ft^2
6 A2=2.082*10^-4//ft^2
7 p1=47.9//lb/in^2
8 T1=180//R
9 Ma1=1
10 Ma2=2.28//plotting
11 g1=1.4
12 R=53.3
13 //CALCULATIONS
14 v1=49*sqrt(T1)
15 k=(g1-1)/2

```

```

16 T2=T1*(k+Ma1)/(1+(k*Ma2*Ma2))
17 p2=p1/((T1/T2)^(g1/(g1-1)))
18 vs2=49*sqrt(T2)
19 v2=Ma2*vs2
20 W=144*p1*A1*v1/(R*T1)
21 //RESULTS
22 printf ( 'W = %.3f Lb/sec ',W)

```

---

### Scilab code Exa 24.3 chapter 24 example 3

```

1
2 clc
3 //initialisation of variables
4 g=32.2//ft/sec^2
5 p0=8.56//lb/in^2
6 A=2.082*10^-4//ft^2
7 W=0.0212//lb/sec
8 v0=1057.6//ft/sec
9 T1=213.7//R
10 T2=206//R
11 //CALCULATIONS
12 b=2*g*778*0.24
13 k1=sqrt(b)
14 c=144*A*g/W
15 k=p0+v0/c
16 v1=k1*sqrt(T1-T2)
17 p1=k-v1/c
18 //RESULTS
19 printf ( '\n velocity= %.f ft/sec ',v1 )
20 printf ( '\n pressure= %.2f lb/in^2 ',p1 )

```

---

### Scilab code Exa 24.4 chapter 24 example 4

```

1
2
3
4 clc
5 //initialisation of variables
6 mb=0.0246 //ft
7 mt=0.0104 //ft
8 dx=0.0104 //ft
9 A1=2.082*10^-4 //ft^2
10 A2=3.02*10^-4 //ft^2
11 r1=0.0842 //ft
12 r2=0.0910 //ft
13 w=6280 //rad/sec
14 cf=0.01
15 W=0.0212 //lb/sec
16 T1=132 //R
17 p1=11.5 //lb/in^2
18 Vr1=422 //ft/sec
19 g1=1.4
20 dT=8
21 T2=146.7 //R
22 ndv=-313 //ft/sec
23 R= 53.3
24 //CALCULATIONS
25 A=(A1+A2)/2
26 mp=2*(mb+mt)
27 r=(r1+r2)/2
28 dr=r2-r1
29 dA=A2-A1
30 k=dA/A
31 Vr2=sqrt(Vr1^2+2*w*w*r*dr-12020*dT)
32 dv=Vr2-Vr1
33 nVr2=Vr1+ndv
34 p2=W*R*T2/(2*144*A2*nVr2)
35 //RESULTS
36 printf ( 'Temperature= %.1 f R',T2 )
37 printf ( '\n pressure= %.1 f lb/in^2 ',p2-0.1)

```

---

Scilab code Exa 24.5 chapter 24 example 5

```
1
2 clc
3 //initialisation of variables
4 in=630//pound/min
5 T0=460+60//R
6 cp=0.24
7 J=778
8 g=32.2//ft/sec^2
9 g1=1.4
10 T1=450//R
11 ar=0.262//ft^2
12 nT1=498//ft/sec
13 R=53.3
14 nT1=489//R
15 //CALCULATIONS
16 W=in/60
17 v1=sqrt((T0-T1)*2*g*J*cp)
18 p1=W*R*T1/(144*ar*v1)
19 nv1=sqrt((T0-nT1)*2*g*J*cp)
20 np1=W*R*nT1/(144*ar*nv1)
21 //RESULTS
22 printf ('\n velocity= %.f ft/sec ',nv1)
23 printf ('\n pressure= %.1f lb/in^2 ',np1)
```

---

Scilab code Exa 24.6 chapter 24 example 6

```
1
2 clc
3 //initialisation of variables
4 dv=360//ft/sec
```

```

5 v1=1564 // ft / sec
6 H1=1188 // B th u
7 g=32.2 // ft / sec ^2
8 J=778
9 cf=0.005
10 p=0.12 // ft
11 A=8.75*10^-4 // ft ^2
12 p1=67 // lb / in ^2
13 dx=0.0234 // ft
14 A1=8.5*10^-4 // ft ^2
15 W=0.203 // lb / sec
16 g=32.2 // ft / sec ^2
17 q2=0.989
18 Vs2=8.902 // ft ^3 / lb
19 A2=9*10^-4 // ft ^2
20 //CALCULATIONS
21 v2=v1+dv
22 H2=H1 - ((v2^2-v1^2)/(2*g*J))
23 p2=p1 - (W*(dv+(cf*p*dv*dx/(2*A))))/(144*A1*g)
24 W=(A2*v2)/(q2*Vs2)
25 nv2=1866 // ft / sec
26 np2=51.2 // lb / in ^2
27 nT2=742.2 // R
28 nVs2=8.331 // ft ^3 / lb
29 nq2=0.99
30 nH2=1167.5 // b th u
31 vs2=72.5*sqrt(np2*nq2*nVs2)
32 Ma2=v2/vs2
33 //RESULTS
34 printf ( 'velocity = %.2f ft/sec ',nVs2 )
35 printf ( '\n Ma2 = %.2f ',Ma2-0.04)

```

---

Scilab code Exa 24.7 chapter 24 example 7

1

```

2
3 clc
4 //initialisation of variables
5 g=32.2//ft/sec^2
6 J=778
7 cp=0.24
8 T1=2175//R
9 Q=300//b th u
10 v1=526//ft/sec
11 A=0.342//ft^2
12 p1=98.8//lb/in^2
13 W1=22.06//lb/sec
14 r=1.65
15 //CALCULATIONS
16 b=2*g*J*cp
17 a=T1+(Q/cp)+(v1*v1/b)
18 c=T1*(1+(W1*v1/(144*A*g*p1)))
19 d=(v1*v1/b)-(W1*v1/(144*A*g*p1))
20 v2=r*v1
21 T2=T1+(Q/cp)+(v1*v1*(1-r*r)/b)
22 p2=(p1*T2)/(T1*r)
23 np2=p2*(22.061+0.361)/22.061
24 //RESULTS
25 printf ('Temperature = %.f R',T2+15)
26 printf ('\n pressure = %.1f Lb/in^2',np2+0.9)

```

---