Q1A.

```
# Given Data
Q = float(input("Enter the value of Discharge (m³/s): "))
T = float(input("Enter the value of top width (m): "))
g = float(input("Enter the value of acceleration due to Gravity (m/s²): "))
y1 = float(input("Enter the value of upstream depth (m): "))
Z = float(input("Enter the value of hump height (m): "))
# Discharge per meter width
q = Q / T
print("The value of discharge per meter width is:", q)
# Area Calculation
A1 = T * y1
print("The value of upstream area is:", A1)
# Froude Number
Fr1 = ((Q**2) * T / (g * (A1**3))) ** 0.5
print("The value of Froude number is:", Fr1)
if Fr1 > 1:
   print("The flow is Super Critical Flow")
else:
   print("The flow is Sub Critical Flow")
# Upstream Energy
E1 = y1 + (Q**2) / (2 * g * (A1**2))
print("The value of Energy at initial Section is:", E1)
# Downstream Energy
E2 = E1 - Z
print("The value of downstream Energy E2 is:", E2)
# Critical Depth
yc = (q**2 / g) ** (1/3)
print("The Value of critical depth is:", yc)
# Critical Energy
Ec = 1.5 * yc
```

```
print("The value of critical Energy is:", Ec)

# Safety Check

if Ec > E2:

   print("Chocking Condition")

else:

   print("SAFE")

# Maximum Hump Height without affecting upstream

Zmax = E1 – Ec
```

OUTPUT-

print("The value of maximum hump is:", Zmax)

Enter the value of Discharge (m^3/s): 4.8

Enter the value of top width (m): 2

Enter the value of acceleration due to Gravity (m/s^2): 9.81

Enter the value of upstream depth (m): 1.6

Enter the value of hump height (m): 0.1

The value of discharge per meter width is: 2.4

The value of upstream area is: 3.2

The value of Froude number is: 0.3786140830096141

The flow is Sub Critical Flow

The value of Energy at initial Section is: 1.714678899082569

The value of downstream Energy E2 is: 1.614678899082569

The Value of critical depth is: 0.837370824744677

The value of critical Energy is: 1.2560562371170154

SAFE

The value of maximum hump is: 0.45862266196555357

Q1B.

```
# Given Data

Q = float(input("Enter the value of Discharge (m^3/s): "))
```

```
T = float(input("Enter the value of top width (m): "))
g = float(input("Enter the value of acceleration due to Gravity (m/s^2): "))
y1 = float(input("Enter the value of upstream depth (m): "))
Z = float(input("Enter the value of hump height (m): "))
# Discharge per meter width
q = Q / T
print("The value of discharge per meter width is:", q)
# Area Calculation
A1 = T * y1
print("The value of upstream area is:", A1)
# Froude Number
Fr1 = ((Q**2) * T / (g * (A1**3))) ** 0.5
print("The value of Froude number is:", Fr1)
if Fr1 > 1:
   print("The flow is Super Critical Flow")
else:
   print("The flow is Sub Critical Flow")
# Upstream Energy
E1 = y1 + (Q**2) / (2 * g * (A1**2))
print("The value of Energy at initial Section is:", E1)
# Downstream Energy
E2 = E1 - Z
print("The value of downstream Energy E2 is:", E2)
# Critical Depth
yc = (q**2 / g) ** (1/3)
print("The Value of critical depth is:", yc)
# Critical Energy
Ec = 1.5 * yc
print("The value of critical Energy is:", Ec)
# Safety Check
if Ec > E2:
```

```
    print("Chocking Condition")
else:
    print("SAFE")
# Maximum Hump Height without affecting upstream
Zmax = E1 - Ec
print("The value of maximum hump is:", Zmax)
```

OUTPUT-

```
Enter the value of Discharge (m³/s): 4.8
Enter the value of top width (m): 2
Enter the value of acceleration due to Gravity (m/s²): 9.81
Enter the value of upstream depth (m): 1.6
Enter the value of hump height (m): 0.5
The value of discharge per meter width is: 2.4
The value of upstream area is: 3.2
The value of Froude number is: 0.3786140830096141
The flow is Sub Critical Flow
The value of Energy at initial Section is: 1.714678899082569
The value of downstream Energy E2 is: 1.214678899082569
The Value of critical depth is: 0.837370824744677
The value of critical Energy is: 1.2560562371170154
Chocking Condition
The value of maximum hump is: 0.45862266196555357
```

Q2.

```
# Given Data
Q = float(input("Enter the value of Discharge (m³/s): "))
B1 = float(input("Enter the value of width at upstream (m): "))
B2 = float(input("Enter the value of width at downstream (m): "))
g = float(input("Enter the value of acceleration due to Gravity (m/s²): "))
```

```
y1 = float(input("Enter the value of upstream depth (m): "))
# Discharge per unit width
q1 = Q / B1
q2 = Q / B2
print("Discharge per meter width at upstream:", q1)
print("Discharge per meter width at downstream:", q2)
# Area Calculation
A1 = B1 * y1
print("The value of upstream area is:", A1)
# Froude Number
Fr1 = ((Q**2) * B1 / (g * (A1**3))) ** 0.5
print("The value of Froude number is:", Fr1)
if Fr1 > 1:
  print("The flow is Super Critical Flow")
else:
  print("The flow is Sub Critical Flow")
# Upstream Energy
E1 = y1 + (Q**2) / (2 * g * (A1**2))
print("The value of Energy at initial Section is:", E1)
# Minimum width to avoid choking
B2min = ((27 * Q**2) / (8 * g * E1**3)) ** 0.5
print("Minimum width to avoid choking is:", B2min)
if B2min > B2:
  print("Chocking Condition")
else:
  print("SAFE")
# Critical Depth and Energy at contracted section
yc = (Q**2 / (B2**2 * g)) ** (1/3)
print("The Value of critical depth is:", yc)
Ec = 1.5 * yc
print("The value of critical Energy is:", Ec)
```

OUTPUT-

Enter the value of Discharge (m^3/s): 15

Enter the value of width at upstream (m): 3.5

Enter the value of width at downstream (m): 2.5

Enter the value of acceleration due to Gravity (m/s^2): 9.81

Enter the value of upstream depth (m): 2

Discharge per meter width at upstream: 4.285714285714286

Discharge per meter width at downstream: 6.0

The value of upstream area is: 7.0

The value of Froude number is: 0.4837753296275688

The flow is Sub Critical Flow

The value of Energy at initial Section is: 2.234038569556263

Minimum width to avoid choking is: 2.634860603070728

Chocking Condition

The Value of critical depth is: 1.5424502472009343

The value of critical Energy is: 2.3136753708014015

Q3.

```
Q = float(input("Enter the value of Discharge (m³/s): "))

n = float(input("Enter the value of Rugosity coefficient: "))

So = float(input("Enter the value of bed slope: "))

g = float(input("Enter the value of acceleration due to Gravity (m/s²): "))

# Depth of flow using Manning's formula (approximate)

yn = ((Q * n / (So**0.5)) * 1.591 / 1.732) ** (3/8)

print("The Value of normal depth (yn) is:", yn)

# Freeboard adjustment

yn1 = 1.1 * yn

print("Depth including freeboard (yn1) is:", yn1)

# Cross-sectional Area
```

```
A = 1.732 * yn * yn1
print("Cross sectional Area A is:", A)
# Top Width and Bottom Width
T = 4 * yn / 1.732
print("Top Width T is:", T)
B = 2 * yn / 1.732
print("Bottom Width B is:", B)
# Froude Number
Fr = ((Q**2 * T) / (g * A**3)) ** 0.5
print("Froude number is:", Fr)
if Fr > 1:
    print("The flow is Super Critical Flow")
else:
    print("The flow is Sub Critical Flow")
```

OUTPUT-

Enter the value of Discharge (m^3/s): 100

Enter the value of Rugosity coefficient: 0.015

Enter the value of bed slope: 0.0004

Enter the value of acceleration due to Gravity (m/s^2): 9.81

The Value of normal depth (yn) is: 4.89011230647273

Depth including freeboard (yn1) is: 5.3791235371200035

Cross sectional Area A is: 45.559425534364046

Top Width T is: 11.293561908713002

Bottom Width B is: 5.646780954356501

Froude number is: 0.3489101517794554

The flow is Sub Critical Flow