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#Question:1
# To find the downstream depth of open channel

# Given Data
Q = float(input("Enter the value of Discharge (Q): "))  # Discharge
T = float(input("Enter the value of top width (T): "))  # Top width
g = float(input("Enter the value of acceleration due to Gravity (g): "))  # Gravity
y1 = float(input("Enter the value of upstream depth (y1): "))  # Upstream depth
Z = float(input("Enter the value of hump height (Z): "))  # Hump height

# Discharge per meter width
q = Q / T
print("The value of discharge per meter width is:", q)

# Area Calculation (Upstream)
A1 = T * y1
print("The value of upstream area is:", A1)

# Calculation of Froude Number
Fr1 = (Q**2 * T) / (g * A1**3) ** 0.5
print("The value of Froude number is:", Fr1)

# Flow classification based on Froude number
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 Calculation
yc = (q**2 / g)**(1/3)
print("The value of critical depth is:", yc)

# Critical Energy Calculation
Ec = 1.5 * yc
print("The value of critical Energy is:", Ec)

# Choking Condition
if Ec > E2:
    print("Choking Condition")
else:
    print("SAFE")

# Calculation of Maximum Hump Height (Zmax)
Zmax = E1 - Ec
print("The value of maximum hump height (Zmax) is:", Zmax)
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Enter the value of Discharge (Q): 4.8
Enter the value of top width (T): 2
Enter the value of acceleration due to Gravity (g): 9.81
Enter the value of upstream depth (y1): 1.6
Enter the value of hump height (Z): 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: 2.5701176212687153
The flow is Super 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
Choking Condition
The value of maximum hump height (Zmax) is: 0.45862266196555357
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#Question:2
# To find the downstream depth of open channel

# Given Data
Q = float(input("Enter the value of Discharge (Q): "))  # Discharge
B1 = float(input("Enter the value of width at upstream (B1): "))  # Upstream width
B2 = float(input("Enter the value of width at downstream (B2): "))  # Downstream width
g = float(input("Enter the value of acceleration due to Gravity (g): "))  # Gravity
y1 = float(input("Enter the value of upstream depth (y1): "))  # Upstream depth

# Discharge per meter width
q1 = Q / B1
q2 = Q / B2

print("The value of discharge per meter width at upstream (q1) is:", q1)
print("The value of discharge per meter width at downstream (q2) is:", q2)

# Area Calculation (Upstream)
A1 = B1 * y1
print("The value of upstream area (A1) is:", A1)

# Calculation of Froude Number
Fr1 = ((Q**2 * B1) / (g * A1**3)) ** 0.5
print("The value of Froude number (Fr1) is:", Fr1)

# Flow classification based on Froude number
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 (E1) is:", E1)

# Minimum downstream width to avoid chocking
B2min = ((27 * Q**2) / (8 * g * E1**3)) ** 0.5
print("The value of minimum width to avoid chocking (B2min) is:", B2min)
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if B2min > B2:
    print("Choking Condition")
else:
    print("SAFE")

# Critical Depth Calculation
yc = ((Q**2) / (B2**2 * g)) ** (1/3)
print("The value of critical depth (yc) is:", yc)

# Critical Energy Calculation
Ec = 1.5 * yc
print("The value of critical Energy (Ec) is:", Ec)
232
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```
Enter the value of Discharge (Q): 15
Enter the value of width at upstream (B1): 3.5
Enter the value of width at downstream (B2): 2.5
Enter the value of acceleration due to Gravity (g): 9.81
Enter the value of upstream depth (y1): 2
The value of discharge per meter width at upstream (q1) is: 4.285714285714286
The value of discharge per meter width at downstream (q2) is: 6.0
The value of upstream area (A1) is: 7.0
The value of Froude number (Fr1) is: 0.4837753296275688
The flow is Sub Critical Flow
The value of Energy at initial Section (E1) is: 2.234038569556263
The value of minimum width to avoid chocking (B2min) is: 2.634860603070728
Choking Condition
The value of critical depth (yc) is: 1.5424502472009343
The value of critical Energy (Ec) is: 2.3136753708014015
232
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#Question:30
# Design of Efficient Channel Section

# Given Data
Q = float(input("Enter the value of Discharge (Q): "))  # Discharge
n = float(input("Enter the value of Rugosity coefficient (n): "))  # Manning's n
So = float(input("Enter the value of bed slope (So): "))  # Bed slope
g = float(input("Enter the value of acceleration due to Gravity (g): "))  # Gravity

# Manning's Formula
# Q = (AR^2/3 * S^1/2) / n
yn = ((Q * n * 50 * 1.591) / 1.732) ** (3 / 8)
print("The Value of yn (normal depth) is:", yn)

# To encounter the effect of freeboard (increased depth)
yn1 = 1.1 * yn
print("The Value of yn1 (depth with freeboard) is:", yn1)

# Cross-Sectional Area
A = 1.732 * yn * yn1
print("The cross-sectional area is:", A)

# Top Width
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T = 4 * yn / 1.732
print("The value of top width (T) is:", T)

# Bottom Width
B = 2 * yn / 1.732
print("The value of bottom width (B) is:", B)

# Calculation of Froude Number
Fr = ((Q**2 * T) / (g * A**3)) ** 0.5
print("The value of Froude number (Fr) is:", Fr)

# Flow classification based on Froude number
if Fr > 1:
    print("The flow is Super Critical Flow")
else:
    print("The flow is Sub Critical Flow")
```

```
Enter the value of Discharge (Q): 100
Enter the value of Rugosity coefficient (n): 0.015
Enter the value of bed slope (So): .0004
Enter the value of acceleration due to Gravity (g): 9.81
The Value of yn (normal depth) is: 4.89011230647273
The Value of yn1 (depth with freeboard) is: 5.3791235371200035
The cross-sectional area is: 45.559425534364046
The value of top width (T) is: 11.293561908713002
The value of bottom width (B) is: 5.646780954356501
The value of Froude number (Fr) is: 0.3489101517794554
The flow is Sub Critical Flow
```