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fck = float(input(" Enter the value of characteristic compressive strength:"))
# Experimental Determinations
Gca = float(input ("Enter the value of specific gravity of CA: "))
Gfa = float(input("Enter the value of specific gravity of FA: "))
Gc = float(input("Enter the value of specific gravity of Cement: "))
Water_Density = float(input("Enter the value of Water Density: "))
AGG_Size = float(input(" Enter the nominal Size of Aggregate: "))
Nature_of_AGG = (input("Nature of Aggregates:"))
Slump = float(input("Enter the value of workability of concrete: "))
Admixture = (input("Type of Admixture:"))
Exposure_Condition = (input("Exposure Condition:"))
Concreting = (input("Type of Concreting:"))
Zone = int(input("Zone: "))
# Target Mean Strength

sigma = {
10:3.5,
15:3.5,
20: 4,
25:4,
30: 5,
35: 5,
40: 5,
45: 5,
50: 5,
55: 5
}
ft = fck + sigma[fck]*1.65
print("Target Mean Strength: ", ft, "MPa'")

# Maximum free Water Cement Ratio
# Reference IS 456: 2000 Table 5

if(Concreting == "Plain"):
    WC_ratio = {
        "Mild" : 0.6,
        "Moderate" :0.6,
        "Severe" :0.5,
        "Very Severe" :0.45,
        "Extreme":0.4
    }
else:
    WC_ratio = {
        "Mild": 0.55,
        "Moderate":0.5,
        "Severe" :0.45,
        "Very Severe" :0.45,
        "Extreme":0.4
    }

print("W/C Ratio:", WC_ratio[Exposure_Condition] )
WC_ratio = WC_ratio [Exposure_Condition]

# Minimum Cement Content

if(Concreting == "plain"):
    Min_Cement_Content = {
        "Mild":220.
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    "Moderate": 240,
    "Severe": 250,
    "Very Severe": 260,
    "Extreme": 280
}
else:
    Min_Cement_Content = {
    "Mild": 300,
    "Moderate" :300 ,
    "Severe" : 320,
    "Very Severe" :340,
    "Extreme": 360
    }

print("Minum Cement Content:", Min_Cement_Content[Exposure_Condition], "kg/m^3")

# Water Content

Water_Content = {
10:208,
20:186,
40:165
}

Water_Content = Water_Content[AGG_Size]
if (Slump == 75):
    Water_Content = Water_Content + Water_Content*0.03
elif (Slump == 100):
    Water_Content = Water_Content + Water_Content*0.06
elif (Slump == 125):
    Water_Content = Water_Content + Water_Content*0.09
elif (Slump == 150):
    Water_Content = Water_Content + Water_Content*0.12
elif (Slump == 175):
    Water_Content = Water_Content + Water_Content*0.15
elif (Slump == 200):
    Water_Content = Water_Content + Water_Content*0.18

if (Nature_of_AGG == "Sub-Angular"):
    Water_Content = Water_Content - 10
elif (Nature_of_AGG == "Gravel"):
    Water_Content = Water_Content - 20
elif (Nature_of_AGG == "Round"):
    Water_Content = Water_Content - 25

if (Admixture == "Plastisizer"):
    Water_Content = Water_Content-(0.1*Water_Content)
elif (Admixture=="Super-plastisizer"):
    Water_Content = Water_Content-(0.2*Water_Content)

print("Water Content: ", Water_Content, "kg/m^3")

# Cement Content

Cement_Content = Water_Content/WC_ratio
print("Cement Content:", Cement_Content, "kg/m^3")

print("As Per IS 456:2000, Maximum allowed Cement Content is 450 kg/m^3")

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if (Cement_Content< 450):
    Cement_Content = Cement_Content
else:
    Cement_Content = 450
if Cement_Content< 450:
    print("Safe")

# Volume Calculations
Vol_Cement = Cement_Content/(Gc*Water_Density)
print("Volume of Cement: ", Vol_Cement, "m^3")

Vol_Water = Water_Content/Water_Density
print("Volume of Water: ", Vol_Water, "m^3")

Vol_AGG= 1-Vol_Water - Vol_Cement
print("Volume of Course Aggregates and Fine Aggregates: ", Vol_AGG, "m^3")

Zone_ID = {}

Zone_ID[1] = {10:0.44, 20:0.60, 40:0.69}
Zone_ID[2] = {10:0.46, 20:0.62, 40:0.71}
Zone_ID[3]={10:0.48, 20:0.64, 40:0.73}
Zone_ID[4]={10:0.5, 20:0.66, 40:0.75}

Fraction = Zone_ID[Zone] [AGG_Size]

if (WC_ratio==0.5) :
    Fraction=Fraction
elif (WC_ratio==0.45) :
    Fraction=Fraction+(0.01*Fraction)
elif (WC_ratio==0.4):
    Fraction=Fraction+(0.02 * Fraction)
elif (WC_ratio==0.55):
    Fraction=Fraction-(0.01*Fraction)
elif (WC_ratio==0.60):
    Fraction=Fraction-(0.02*Fraction)

print("Course Aggregate fraction:", Fraction)

Vol_CA = Vol_AGG*Fraction
print("Volume of Course Aggregate:", Vol_CA,"m^3")

Vol_FA = Vol_AGG-Vol_CA
print("Volume of Fine Aggregate: ", Vol_FA,"m^3")

Mass_CA= Vol_CA*Gca* Water_Density
print("Mass of Course Aggregates: ", Mass_CA, "Kg/m^3")

Mass_FA = Vol_FA*Gfa*Water_Density
print("Mass of Fine Aggregates:", Mass_FA, "kg/m^3")

# Ratios
print("Weight Batching")
print(Cement_Content/Cement_Content,":", Mass_FA/Cement_Content,":", Mass_CA/Cement_Content,":",Wat

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print("Volume Batching:")
print(Vol_Cement/Vol_Cement,":", Vol_FA/Vol_Cement,":", Vol_CA/Vol_Cement,":", Vol_Water/Vol_Cemen
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Enter the value of characteristic compressive strength:40
 Enter the value of specific gravity of CA: 2.74
 Enter the value of specific gravity of FA: 2.74
 Enter the value of specific gravity of Cement: 3.15
 Enter the value of Water Density: 1000
 Enter the nominal Size of Aggregate: 20
 Nature of Aggregates:Sub-Angular
 Enter the value of workability of concrete: 100
 Type of Admixture:Super-Plastisizer
 Exposure Condition:Severe
 Type of Concreting:Reinforced
 Zone: 1
 Target Mean Strength: 48.25 MPa'
 W/C Ratio: 0.45
 Minmum Cement Content: 320 kg/m³
 Water Content: 187.16 kg/m³
 Cement Content: 415.9111111111111 kg/m³
 As Per IS 456:2000, Maximum allowed Cement Content is 450 kg/m³
 Safe
 Volume of Cemnet: 0.1320352733686067 m³
 Volume of Water: 0.18716 m³
 Volume of Course Aggregates and Fine Aggregates: 0.6808047266313932 m³
 Course Aggregate fraction: 0.606
 Volume of Course Aggregate: 0.4125676643386243 m³
 Volume of Fine Aggregate: 0.26823706229276895 m³
 Mass of Course Aggregates: 1130.4354002878308 Kg/m³
 Mass of Fine Aggregates: 734.969550682187 kg/m³
 Weight Batching
 1.0 : 1.7671313197637537 : 2.7179735527330835 : 0.45
 Volume Batching:
 1.0 : 2.0315560792904463 : 3.1246776244924126 : 1.4174999999999998