```
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: "))
A/C_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,
"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 ("Minimum 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 == 25):
  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*0.08
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/w_c_ratio
print("Cement_Content:", Cement_Content, "kg/m^3")

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

if (Cement_Content<450):
  Cement_Content = Cement_Content
else:
  Cement_Content=450

  if Cement_Content< 450
    print("Safe")

# Volume Calculations

Vol_Cement = Cement_Content/(G*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):
```

```python
    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>=[illegible]):
    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,":",Water_Content/Cement_Content)

print("Volume Batching:")
print(Vol_Cement/Vol_Cement,":",Vol_FA/Vol_Cement,":", Vol_CA/Vol_Cement,":",Vol_Water/Vol_Cement)
```

```
Enter the value of characteristic compressive strength: 40
Enter the value of specific gravity of CA: 2.78
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-Plasticizer
Exposure Condition:Severe
Type of Concreting:Reinforced
Zone: 1
Target Mean Strength: 48.25 MPa
W/C Ratio: 0.45
Minimum Cement Content: 320 kg/m^3
Water Content: 187.16 kg/m^3
Cement_Content: 415.91111111111 kg/m^3
As Per IS 456:2000, Maximum allowed Cement Content is 450 kg/m^3
Volume of Cement: 0.13203527336860067 m^3
Volume of Water: 0.18716 m^3
Volume of Course Aggregates and Fine Aggregates: 0.6808047266311932 m^3
Course Aggregate fraction: 0.606
Volume of Course Aggregate: 0.41256766433866243 m^3
Volume of Fine Aggregate: 0.26823706622927695 m^3
Mass of Course Aggregates: 1146.9154061028308 kg/m^3
Mass of Fine Aggregates: 734.9695614682187 kg/m^3
Weight Batching
1.0 : 1.7671313197637537 : 2.7579735527330815 : 0.45
Volume Batching
1.0 : 2.0315560792904463 : 3.1246776244924126 : 1.4174999999999908
```