```
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,
"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 ("Minmum 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")

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 Cemnet: ", 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,":",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: 2.74
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-Plasticizer
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/m^3
Water Content:  187.16 kg/m^3
Cement_Content: 415.91111111111111 kg/m^3
As Per IS 456:2000, Maximum allowed Cement Content is 450 kg/m^3
Volume of Cemnet:  0.1320352733686067 m^3
Volume of Water:  0.18716 m^3
Volume of Course Aggregates and Fine Aggregates:  0.6808047266313932 m^3
Course Aggregate fraction: 0.606
Volume of Course Aggregate: 0.4125676643386243 m^3
Volume of Fine Aggregate:  0.26823706229276895 m^3
Mass of Course Aggregates:  1130.4354002878308 Kg/m^3
Mass of Fine Aggregates: 734.969550682187 kg/m^3
Weight Batching
1.0 : 1.7671313197637537 : 2.7179735527330835 : 0.45
Volume Batching:
1.0 : 2.0315560792904463 : 3.1246776244924126 : 1.4174999999999998
```