#Roshan Chawan 22CV013

# Design of tension member

Tu = float(input("Enter the value of ultimate tensile strength:"))

fy = float(input("Enter the value of yield strength of steel:"))

fu = float(input("Enter the value of ultimate strength of steel:"))

fub = float(input("Enter the value of ultimate strength of bolt:"))

Gamma\_mo = float(input("Enter the value of partial factor of safety Garmma mo:"))

Gamma\_m1 = float(input("Enter the value of partial factor of safety Garmma\_m1:"))

Gamma\_mb = float(input("Enter the value of partial factor of safety Gamma\_mb:"))

print("Gross Area Required")

Agreq = 1.1 \* Tu \* 1000 / fy

print("The value of gross area required is:", 1.2 \* Agreq)

# Selection of section

# Selecting ISA 100x65x8

Ag = float(input("Enter the value of gross area of steel is:"))

Lcl = float(input("Enter the length of connected leg:"))

Lol = float(input("Enter the length of outstand leg:"))

t = float(input("Entert the value of least thickness: "))

Ag = 1257

# Design of connections

d = float(input("Enter the value of diameter of bolt:"))

do = d + 2

print("The diameter of bolt hole is:", do)

# As per IS code minimum pitch distance is

pmin = 2.5 \* d

print("The minimum pitch is:", pmin)

# Edge distance as per IS 800 is

e = 1.5 \* do

print("Enter the value of edge distance:", e)

nn = float(input("Number of shear planes with threaded intercepting the shear plane:"))

ns = float(input("Number of shear plane without threads:"))

Anb = 0.78 \* 0.7854 \* d \* d

print("threaded area of bolt is:", Anb)

Asb = 0.7854 \* d \* d

print("plane shank area of bolt is:", Asb)

Vdsb = (fub / (1.732 \* Gamma\_mb) \* (nn \* Anb + ns \* Asb) \* 10\*\*-3)

print("The value of Vdsb:", Vdsb)

kb1 = e / (3 \* do)

print("Kbl:", kb1)

kb2 = (pmin / (3 \* do)) - 0.25

print("Kb2:", kb2)

kb3 = fub / fu

print("Kb3:", kb3)

kb4 = 1

print("Kb4:", kb4)

kb = min(kb1, kb2, kb3, kb4)

print("Kb:", kb)

Vdpb = (2.5 \* kb \* d \* t \* fu \* 10\*\*-3) / Gamma\_mb

print("Vdpb:", Vdpb)

Vd = min(Vdsb, Vdpb)

print("Vd:", Vd)

N = Tu / Vd

print("Number of bolts requird:", N)

N = float(input("Enter the value of number of bolts:"))

# Check for strength

# Criteria 1 Yielding of Gross Section

Tdg = (Ag \* fy \* 10\*\*-3) / Gamma\_mo

print("The value of tensile strength due to yielding of gross section is:", Tdg)

# Criteria 2 Rupture

Anc = (Lcl - (t / 2) - do) \* t

print("Net Area of Connecting leg is: (Anc):", Anc)

Ago = (Lol - (t / 2)) \* t

print("Gross Area of outstand leg is: (Anc):", Ago)

Lc = (N - 1) \* pmin

print("Le:", Lc)

bs = 0.6 \* Lcl + Lol + t

print("bs:", bs)

Beta = (fy / fu) \* (bs / Lc) \* (Lol / t)

print("Beta:", Beta)

print("Check 1")

if Beta > 1.4:

    print("Not Safe")

else:

    print("'Safe")

    print("Check 2")

if Beta < 0.7:

    print("Not Safe")

else:

    print("'Safe")

Tdn = ((0.9 \* fu \* Anc) / Gamma\_m1) + (Beta \* Ago \* fy / Gamma\_mo)

print("'Tdn:", Tdn)

# Criteria 3 Block Shear

Avg = (pmin \* (N - 1) + e) \* t

print("'Avg:", Avg)

Avn = ((pmin \* (N - 1) + e) - (N - 1) \* do + (8.5 \* do)) \* t

print("Avn:", Avn)

Atg = 0.6 \* Lcl \* t

print("Atg:", Atg)

Atn = Atg - 0.5 \* do

print("Atn:", Atn)

Tb1 = (((Avg \* fy) / (1.732 \* Gamma\_mo)) + (0.9 \* fu \* Atn) / Gamma\_m1) \* 10\*\*-3

print("Tb1:", Tb1)

Tb2 = ((0.9 \* Avn \* fu) / (1.732 \* Gamma\_m1) + (Atg \* fy) / Gamma\_mo) \* 10\*\*-3

print("Tb2:", Tb2)

Tb = min(Tb1, Tb2)

print("Tb", Tb)

Td = min(Tdg, Tdn, Tb)

print("Td", Td)

if Td > Tu:

    print("SAFE")

else:

    print("Revise the Section")

Output-:

Enter the value of ultimate tensile strength:225

Enter the value of yield strength of steel:250

Enter the value of ultimate strength of steel:410

Enter the value of ultimate strength of bolt:400

Enter the value of partial factor of safety Gamma mo:1.1

Enter the value of partial factor of safety Garmma\_m1:1.25

Enter the value of partial factor of safety Gamma\_mb:1.25

Gross Area Required

The value of gross area required is: 1188.0

Enter the value of gross area of steel is:1257

Enter the length of connected leg:100

Enter the length of outstand leg:65

Enter the value of least thickness: 8

Enter the value of diameter of bolt:20

The diameter of bolt hole is: 22.0

The minimum pitch is: 50.0

Enter the value of edge distance: 33.0

Number of shear planes with threaded intercepting the shear plane:1

Number of shear plane without threads:0

threaded area of bolt is: 245.0448

plane shank area of bolt is: 314.16

The value of Vdsb: 45.273866050808316

Kbl: 0.5

Kb2: 0.5075757575757576

Kb3: 0.975609756097561

Kb4: 1

Kb: 0.5

Vdpb: 65.6

Vd: 45.273866050808316

Number of bolts required: 4.969754510195687

Enter the value of number of bolts:5

The value of tensile strength due to yielding of gross section is: 285.6818181818182

Net Area of Connecting leg is: (Anc): 592.0

Gross Area of outstand leg is: (Anc): 488.0

Le: 200.0

bs: 133.0

Beta: 3.2945884146341466

Check 1

Not Safe

'Safe

'Tdn: 540158.2059866962

'Avg: 1864.0

Avn: 2656.0

Atg: 480.0

Atn: 469.0

Tb1: 383.042543439009

Tb2: 561.7763594373295

Tb 383.042543439009

Td 285.6818181818182

SAFE