Assignment 10: Applications of Python in the field of Design of Steel Structures

DATE:

1. Design an unequal ISA to resist the tensile force of 225kN as per IS 800. Use M20 bolts. Assume suitable data if required.

Q1. INPUT

# 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 pin = 2.5\*d

print ("The minimum pitch is:", pin) # 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 = (pin/(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 Yeilding 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)\*pin print ("Le:", Lc)

bs = 0.6\*Lcl+ Lol\*t print ("bs:", bs)

Beta = (fy/fu)\*(bs/Lc)\*(Lol/t)\*1.4\*(0.076\*(fy/tu)\*(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=(pin\* (N-1)+e)\*t print ("Avg:", Avg)

Avn = ((pin\*(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 Garmma 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 Entert 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 requird: 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: 580.0

Beta: 40.0219279302168

Check 1 Not Safe Check 2 Safe

Tdn: 4613554.043169499

Avg: 1864.0

Avn: 2656.0

Atg: 480.0

Atn: 5280.0

Tb1: 1803.249743439009

Tb2: 561.7763594373295

Tb 561.7763594373295

Td 285.6818181818182 SAFE