Part 1: Heat Loss/Gain

1. Determine the U-value for a wall assembly consisting of:

   Wood (Douglas Fir) Bevel Exterior Lapped Sheathing (0.75” x 10”)
   ½” Plywood (Douglas Fir)
   2”x4” Douglas Fir framing with 3-1/2” Mineral Fiber Batt Insulation
   ½” Sound Deadening Board
   ½” Gypsum Board

2. Determine the average weight of one square foot of this wall.
Part 2: Heating and Cooling Loads

Complete the heating and cooling load calculations for the following conditions:

**Building Name**: Miller Office Building  
**Winter Design Conditions**: 8°F ODBT; \( w = 0.0006 \# \) \( H_2O/\# \) of dry air  
**Summer Design Conditions**: 95°F ODBT; MDR: 32 °F

**Building Plan Dimensions**: 90' x 150' (4 stories tall)  
**Gross Wall Area (SF)**: N=4100, E=7200, S=4300, W=7100  
**Glazing Area (SF)**: N=1000, E=1980, S=1208, W=1860

**Wall Description**: 4" Brick  
2" Rigid Insulation  
8" Concrete Block  
0.75" Airspace  
0.5" Gypsum Board

\[ U_{wall} = 0.054 \text{ Btu/sf-}^\circ \text{F} \quad \text{Heat content} = 27.33 \text{ Btu/sf-}^\circ \text{F} \]

**Roof Description**: Built Up Roof  
0.625" Plywood Deck  
1.25" Air Space  
R-19 Insulation  
0.5" Gypsum Board  
0.5" Acoustic Tile

\[ U_{roof} = 0.042 \text{ Btu/sf-}^\circ \text{F} \]

Color: dark

**Slab Description**: Unheated slab on grade; \( U_{slab} = 0.16 \text{ Btu/sf-}^\circ \text{F} \); 48" deep vertically oriented rigid insulation, \( R=5.4 \); Groundwater temperature: 53°F  
Slab Edge Factor (\( F_2 \)) = 0.52

**Window Description**: Glazing: Insulating Double Paned with 0.5" airspace, Clear inside/Heat Absorbing Outside. E=0.15 on surface 2.

Frames: Commercial aluminum with thermal breaks.  
Interior Shading: Low transmittance high reflectance  
Drapes: \( U_{dr} = 0.46; VT= 0.37; SC= 0.32 \)

**Skylight Description**: Glazing: same as windows, no interior shading  
Area (sf): 675 sf.
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Door Description: 1-3/4" Solid urethane foam core with thermal break.
Area (SF): N=18  E=36  S=18  W=36
U_{\text{door}}= 0.19 \text{ Btuh/sf-}^{\circ}\text{F}

Equipment Description: Power Density: 0.5 watt/sf

Lighting Description: Power Density: 1.5 watt/sf
Daylighting Controls: None
Design Lighting Level: 50 fc
Type: Fluorescent

Occupant Description: Offices: seated, moderately active work, no smoking
Winter Interior Conditions: 68°F/45% RH; w= 0.0066
Summer Interior Conditions: 78°F
Number of Occupants: 270
Ventilation Required: 4590 CFM (275,400 CFH)

Using the Heating and Cooling Load Calculation forms (see class website), complete the heating and cooling load calculations for this building. Since the building is positively pressurized, ignore infiltration. For the DETD cooling load calculation, ignore the doors.

1. What is the design heating load?
2. What is the design cooling load?