

The University of Calgary
Department of Mechanical Engineering

ENME 583 Mechanical Systems in Buildings

Winter Session 1997-98
Mid-term Test, 1998 03 24 OPEN BOOK

1. Use the static regain method to show how a reasonable duct size could be
40% calculated for duct section 2 in Figure 1 (attached). The following values are
 supplied:
 - 1) air velocity at n is 11 m/s
 - 2) the friction coefficient for fittings to be taken as 0.20
 - 3) total pressure at “n” is 300 Pa
 - 4) the friction loss up to “n” is 120 Pa

2. Two alternatives are being considered for the south-facing facade of a high-rise
15% office tower (see attached Figure 2). In either case, the south wall would
 have a continuous window along each floor such that 50 percent of the wall is
 glass. What are the relative advantages/disadvantages of the two designs
 in terms of the thermal performance of the building.

3. A building is 20 m deep, 30 m wide and 4 m high. It has steel cladding over
15% rigid insulation that is separated from a 200 mm concrete wall by a small air
 space. What is the heat gain (sensible) through the walls due to air temperature
 difference only if the outdoor temperature is 38 °C and the interior
 temperature is kept at 26 °C? Show all steps in your determination.

4. The building from question 3 experiences 0.1 air changes per hour due to
15% infiltration. What is the heat gain (sensible) if the outdoor temperature is 38 °C
 and the interior temperature is kept at 26 °C? Show all steps in your
 determination.

5. An ideal vapour compression system (100 percent piston displacement) has the
15% following characteristics:
 - refrigerant is Freon 12 - condenser at 35 °C; evaporator at 4 °C
 - the liquid leaving the condenser and entering the expansion valve is saturated
 liquid at condenser pressure
 - the vapour leaves the evaporator and enters the compressor as saturated vapour
 at evaporated pressure
 - crankshaft rotation is 1750 rpm
 - piston displacement is 80 cm³

What is the refrigerant flow rate?

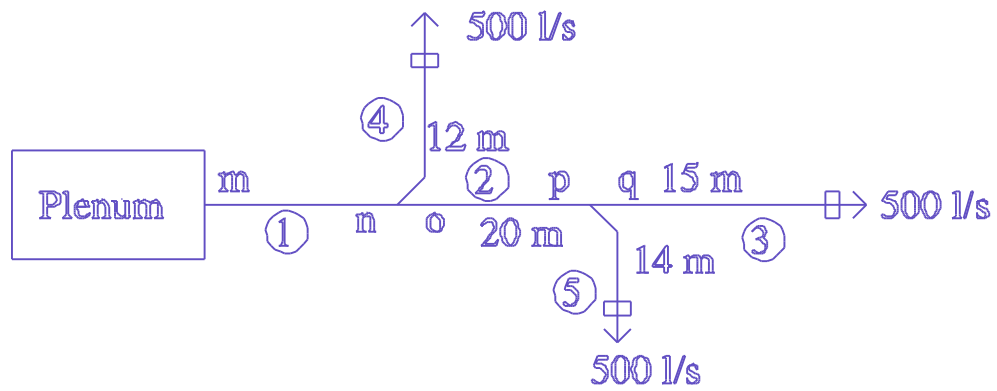


Figure 1. Duct network diagram for question 1

Facade Option 1

Facade Option 2



Figure 2. Facade diagram for question 2