

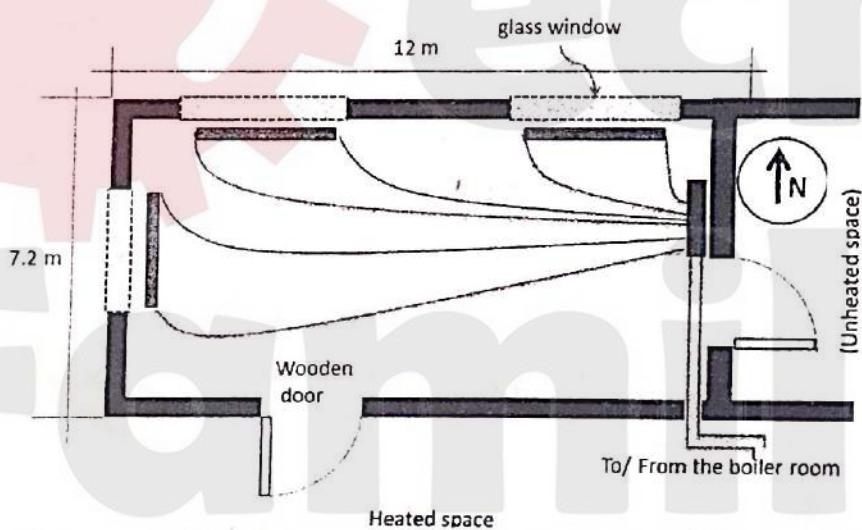
Q1) [25 points]

A lecture room in Amman (Queen Alia Airport) is designed for 50 students, it measures 12 m long and 7.2 m wide, 3 m in height from floor to ceiling. There are:

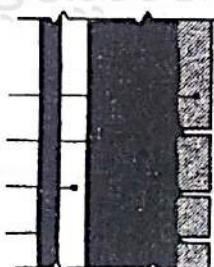
- Two 50 mm- wooden single swing door 1.6 m x 2.25 m.
- Three single glass Aluminum windows each of 4m x 1.5m (sliding windows),
- The U value of the (floor = 0.86 W/m²K) and (ceiling = 0.88 W/m²K).
- The wall construction is shown below.

Calculate:

1. The inside and outside design conditions.
2. The heating load due to the exposed surfaces, walls, door, windows, ceiling and floor.
3. The sensible, latent and total heating load due to ventilation.



k W/m°C	Thickness	Layer
1.70	0.07 m	(1) Stone
1.75	0.15 m	(2) Concrete
0.04	0.05 m	(3) Insulation
1.20	0.03 m	(4) Plaster



Inside design conditions		$T_f = 23.5^\circ\text{C}$	$\phi_f = 50\%$	
Outside design conditions		$T_o = 12^\circ\text{C}$	$\phi_o = 30\%$	
		$T_g = 10.3^\circ\text{C}$	$V_w = 3.4\text{ l}$	
	Area [m ²]	U_{ov} [W/m ² ·°C]	(T _i -T _o) [°C]	\dot{Q}_{loss} [W]
Walls:				
N-Wall	36 x	0.63 /	21 /	317.92
S-Wall	36 x	0.63 /	0 /	0 /
E-Wall	21.6 x	0.63 /	12.9 /	141.75
W-Wall	21.6 x	0.63 /	21 /	206.4 /
Ceiling	86.4 ✓	0.88 /	21 /	150.67
Floor	86.4 ✓	0.96 /	12.7 /	94.77
Windows				
N-Window	12 /	9.6 /	21 /	141.12
S-Window	3.6 /	2.4 /	20 /	10.80
E-Window	3.6 /	2.4 /	12.9 /	10.80
W-Window	6 /	9.6 /	21 /	70.96
Ventilation	Ventilation air rate requirements	\dot{V}_v [m ³ /h]	T _i / T _o /	+
$\dot{Q}_{s,f}$ sensible	4 L/s JD. /	$8 \times 50 = 6.4$ l/sec	23 / 2 /	329.0
			hi / ho	✓
$\dot{Q}_{t,f}$ total			45.5 l/s / 5 /	451.06
$\dot{Q}_{L,f}$ latent				
			$\dot{Q}_{room} =$	

Q2) [5 Points]

- Calculate the domestic hot water heating load required for (500 L/day @ 60°C, cold water from the mains is at 10°C), you need to heat this amount of water during two hours.

$$Q_{DHW} = 44.8 \text{ kJ}$$

- Calculate the mass rate and cost of diesel fuel consumption during the heating season required to heat a residence in Irbid. The calculated heating load for the residence is 25 kW, the Calorific value of diesel is 40 MJ/kg, the boiler efficiency is 85%, the inside design temperature is 21 °C, and the inside relative humidity is 40%. The diesel cost is 0.665 JD/liter.

M _f	Cost