

Week (3)

Question 1:

$$R_{conv_1} = \frac{1}{h_1 \times A} = \frac{1}{10 * (0.015 + 0.22 + 0.015) * 1} = 0.4 \text{ } ^\circ\text{C}/\text{W}$$

$$R_{foam} = \frac{L_f}{K_f \times A} = \frac{1}{0.026 * (0.015 + 0.22 + 0.015) * 1} = 4.615 \text{ } ^\circ\text{C}/\text{W}$$

$$R_{pluster} = \frac{L_p}{(K_p \times A)} = \frac{0.32}{0.22 * 0.015 * 1} = 96.97 \text{ } ^\circ\text{C}/\text{W}$$

$$R_{brick} = \frac{L_b}{(K_b \times A)} = \frac{0.32}{0.22 * 0.72 * 1} = 2.02 \text{ } ^\circ\text{C}/\text{W}$$

$$\frac{1}{R_{total-parallel}} = 2 * \frac{1}{R_{pluster}} + \frac{1}{R_{brick}} = 2 * \frac{1}{96.97} + \frac{1}{2.02} = 0.516 \text{ W}/^\circ\text{C}$$

$$R_{total-parallel} = 1.94 \text{ } ^\circ\frac{\text{C}}{\text{W}}$$

$$R_{pluster} = \frac{L_p}{(K_p \times A)} = \frac{0.02}{0.022 * (0.015 + 0.22 + 0.015) * 1} = 0.363 \text{ } ^\circ\text{C}/\text{W}$$

$$R_{conv_2} = \frac{1}{h_2 \times A} = \frac{1}{40 * (0.015 + 0.22 + 0.015) * 1} = 0.1 \text{ } ^\circ\text{C}/\text{W}$$

$$R_{wall-total} = 0.4 + 4.615 + 0.363 + 1.94 + 0.363 + 0.1 = 7.781 \text{ } ^\circ\text{C}/\text{W}$$

$$\dot{Q} = \frac{30}{7.781} = 3.86 \text{ W}$$

$$R_{wall,total}(\text{thickness of the brick} = 16\text{mm}) = 6.81 \text{ }^{\circ}\frac{C}{W}$$

$$\dot{Q}' = \frac{T_1 - T_{\infty}}{R_{wall,total}(\text{thickness of the brick} = 16\text{mm})} = \frac{20 - (-10)}{6.81} = 4.41W$$

Question 2:

| | Wood | Insulation |
|--------------------------------|-------|------------------------------|
| Outside air | 0.03 | 0.03 |
| Wood bevel (13mm*200mm) | 0.14 | 0.14 |
| Polywood (13mm) | 0.11 | 0.11 |
| Urethane Rigif foam Ins (90mm) | No | $0.98 \cdot 90 / 25 = 3.528$ |
| Wood studs (90mm) | 0.63 | No |
| Gypsum board (13mm) | 0.079 | 0.079 |
| Inside surface | 0.12 | 0.12 |

$$R_{with\ wood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109 \text{ m}^2 \text{ }^{\circ}\frac{C}{W}$$

$$R_{with\ Ins} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.007 \text{ m}^2 \text{ }^{\circ}\frac{C}{W}$$