

TEST- MEN310 (Heat Transfer)

January 03, 2002

1. On a tropical island, a large refrigerated shed (20x20m) has been operating at 5°C for a number of years so that the underground is also at 5°C for an appreciable distance below the surface. It is then put out of service; a wood floor is removed and ambient air at 27°C is allowed to circulate through the shed at a velocity of 5 km/h. How long will it take for the ground 1m below the surface to reach 15°C. The soil is assumed to be wet with a conductivity of 2.6 W/m.K and a diffusivity of $4.5 \times 10^{-7} \text{ m}^2/\text{s}$.
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2. An 8 cm-thick square slab (40x40cm) of resin ($\rho=2600 \text{ kg/m}^3$, $k=1 \text{ W/m.K}$, and $c=800 \text{ J/kg.K}$) is to be cured under an array of air jets at 100°C flowing with a heat transfer coefficient of $40 \text{ W/m}^2\text{C}$, as shown in fig.P2. If the initial temperature of the resin is 20°C, determine the temperature of the back face after 10 minutes using an explicit technique and the grid given. Assume that the back face of the slab is insulated and the edge losses are negligible.

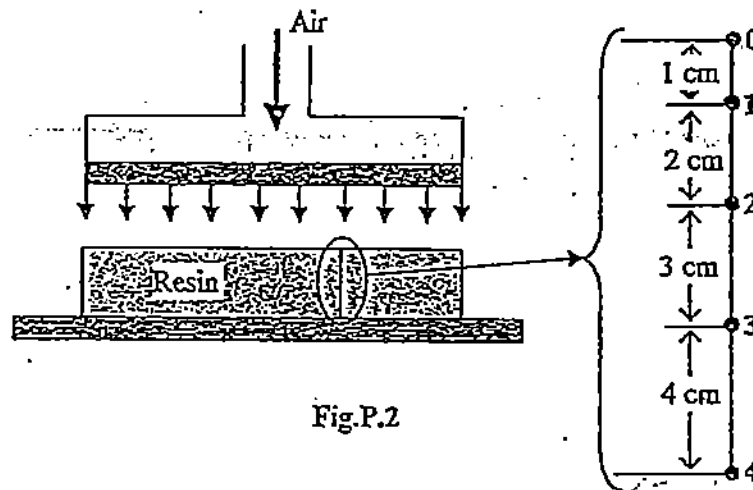


Fig.P.2

Points: 1 (40%), and 2 (60%).