

## ICE for OED with B.C.

### Problem 1.

- A 1 W, 2 Mohm resistor which is 30 mm long has a radius of 1 mm. Determine the peak temperature if the outside surface is held at room temperature.
- Use  $k=0.1 \text{ W/m-K}$  and  $Q=2.1 \text{ MW/m}^2$

$$\begin{aligned}\frac{d^2T}{dr^2} + \frac{1}{r} \frac{dT}{dr} + \frac{Q}{k} &= 0 \\ T(R) &= 20 \text{ C} \\ \frac{dT}{dr}(0) &= 0\end{aligned}$$

### Problem 2.

- Repeat the previous problem with convection to external environment.
- Use  $k=0.1 \text{ W/m-K}$  and  $Q=2.1 \text{ MW/m}^2$
- Also,  $h=10 \text{ W/m}^2\text{-K}$  and  $T_e=20 \text{ C}$

$$\begin{aligned}\frac{d^2T}{dr^2} + \frac{1}{r} \frac{dT}{dr} + \frac{Q}{k} &= 0 \\ h(T(R) - T_e) &= \frac{1}{2} QR \\ \frac{dT}{dr}(0) &= 0\end{aligned}$$