Answer the following questions:

1. Explain with illustration the different methods used for measuring fabric handle. [20 marks]

2. Find theoretically the total thermal resistance of multi-layers of clothing assembly. [30 marks]

3. Prove that air permeability of plain knitted fabric (taking into consideration the different zones within the stitch) can be calculated by the following equation:

$$B = 6S\pi P^4 / 128\,\mu t$$

Where:

B = air permeability, m$^3$/(N.sec).

S = stitch density, m$^{-2}$.

P = average equivalent pore diameter, metre.

μ = air dynamic viscosity, (N.sec)/m$^2$.

t = fabric thickness, metre. [30 marks]

4. Find theoretically the equivalent pore diameter of nonwoven fabrics. [20 marks]

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**With my best wishes**

**Prof. Dr. Hemdan Abou -Taleb**