SBS5312 Lighting Technology

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Tutorial Exercise 01 – Lighting and Daylighting Calculations

1. A general area requires a lighting level of 500 lux from a regular array of louvred luminaries. Given the following data calculate the number of luminaries required and arrange a suitable layout.

   Room dimensions are: length 8 m, width 8 m, height 2.8 m
   Room reflectances: ceiling 0.7, walls 0.5, working plane cavity 0.2
   Working plane height = 0.8 m

Utilisation Factor (*UF*) table for 0.7, 0.5, 0.2 reflectances (*RI* = room index)								
RI =	1.00	1.25	1.50	2.00	2.50	3.00	4.00	5.00
UF =	0.45	0.50	0.53	0.58	0.61	0.63	0.66	0.67

   Maintenance factor = 0.75
   Maximum space to height ratio = 1.75
   Luminaire versions available:
   2 x 1800 mm 70W (each lamp gives) 6550 lumens
   2 x 1500 mm 58W (each lamp gives) 5400 lumens
   2 x 1200 mm 36W (each lamp gives) 3450 lumens
   [Ans.: *RI* = 2.0, *UF* = 0.58, 9 luminaries, layout 3 by 3]

2. A laboratory has dimensions 9 m (depth) x 9 m (width) x 3.4 m (height) and one single-glazed window of 4 m (width) x 2.5 m (height) on the exterior wall. The angle of sky component is 60 degrees, the maintenance factor is 0.75 and the reflection factor is 0.7. Determine the average daylight factor of this room.

   Given: $$DF = \frac{T \times G \times \theta \times MF}{A \times (1 - R^2)}$$

   where DF = average daylight factor (%)
   T = light transmittance (assume 0.85 for clear single glazing)
   G = glazed window area (m^2)
   θ = angle of sky component (degree)
   MF = maintenance factor
   A = total area of interior surfaces including windows (m^2)
   R = reflection factor

   If the window is changed to one double-glazed window (light transmittance is 0.5) of 5 m (width) x 2.4 m (height), what would the average daylight factor be?

   [Ans.: *DF* = 2.64%, when the window is changed to double-glazed *DF* = 1.86%]