Interior Architecture

Ohio University College of Fine Arts School of Art+Design

ART 2640, Building Systems of Interior Environments
Fall Semester 2018
Mondays & Wednesdays 9:40-10:35
Grover Center W209

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Lumen Method Calculation Assignments

Due: Wednesday, November 28, 9:40am

The following assignment addresses the calculation of quantitative lighting data.

1. Figure for Efficacy

Efficacy = Lumens divided by Watts.

Solving for Efficacy

1. Imagine a 60-watt standard 'A' incandescent lamp giving off 850 lumens. What is the lamp's efficacy?

2. Imagine a 100-watt standard 'A' incandescent lamp giving off 1250 lumens. What is the lamp's efficacy?

3. Imagine a 14-watt compact fluorescent lamp giving off 950 mean lumens. What is the lamp's efficacy?

4. Imagine a 30-watt tube fluorescent lamp giving off 2000 mean lumens. What is the lamp's efficacy?

5. Imagine a 100-watt HID metal halide lamp giving off 6800 mean lumens. What is the lamp's efficacy?

6. Imagine a 280-watt HID metal halide lamp giving off 20300 mean lumens. What is the lamp's efficacy?

7. Imagine a 2-watt LED giving off 15 lumens. What is the lamp's efficacy?

8. Imagine a 1.5 watt LED giving off 10 lumens. What is the lamp's efficacy?

9. Imagine a standard 'A' incandescent lamp with an efficacy of 8.4fc per watt if it is using a 25-watt lamp. How many lumens does the lamp produce?

2. Lumen Method Calculations for Large, Open Areas

1 Foot Candle = 1 Lumen ÷ 1 sq. ft.
1 FC = 1 Lm ÷ 1 sq. ft.

Illuminance = Lumens ÷ area
E = Lms ÷ area (sq. ft.)

Solving for Illuminance Level

1. Imagine a room that is 8'-0" x 12'-0", with two fluorescent fixtures. Each fixture houses 3 fluorescent lamps that emit 1500 lumens each. If we imagine that all 1500 lumens from each lamp from each luminaire end up on the floor of the space, what Illuminance level can be expected onto the floor of this room?

2. Imagine a room that is 12'- 0" x 20'-0", with 10 fluorescent fixtures. Each fixture houses 2 fluorescent lamps that emit 1800 lumens each. If we imagine that all 1800 lumens from each lamp from each luminaire end up on the floor of the space, what Illuminance level can be expected onto the floor of this room?

3. Imagine a room that is 10'- 6" x 15'-6", with 5 down-light fixtures that houses a standard incandescent A lamp of 60 watts that emit 1000 lumens each. If we imagine that all 1000 lumens from each lamp from

each luminaire end up on the floor of the space, what Illuminance level can be expected onto the floor of this room?

4. Imagine a room that is 9'- 6" x 13'-6", with 4 down-light fixtures that houses a standard incandescent A lamp of 100 watts that emit 1200 lumens each. If we imagine that all 1200 lumens from each lamp from each luminaire end up on the floor of the space, what Illuminance level can be expected onto the floor of this room?

5. Imagine a room that is 26'- 6" x 18'-6", with 12 fluorescent fixtures. Each fixture houses 4 fluorescent lamps that emit that emit 1300lumens each. If we imagine that all 1300 lumens from each lamp from each luminaire end up on the floor of the space, what Illuminance level can be expected onto the floor of this room?

3. Solving for Lumens or Luminaires Needed.

If **Illuminance = Lumens ÷ Area** then **Lumens = Illuminance x (multiply by) Area / Lms = E x A**

6. Imagine a room that is 8'-0" x 12'-0", receiving an average Illuminance level of 55-foot candles (FC). How many lumens need to make it to the floor surface? How many recessed down-light luminaires housing a standard A incandescent lamp giving off 900 lumens?

7. Imagine a room that is 12'- 0" x 20'-0", receiving an average Illuminance level of 75-foot candles (FC). How many lumens need to make it to the floor surface? How many fluorescent luminaires housing 3 standard T fluorescent lamps with each lamp giving off 1000 lumens?

8. Imagine a room that is 10'- 6" x 15'-6", receiving an average Illuminance level of 45-foot candles (FC). How many lumens need to make it to the floor surface? How many fluorescent luminaires housing 2 standard T fluorescent lamps with each lamp giving off 700 lumens?

9. Imagine a room that is 9'- 6" x 13'-6", receiving an average Illuminance level of 35-foot candles (FC). How many lumens need to make it to the floor surface? How many recessed down-light luminaires housing a standard A incandescent lamp giving off 800 lumens?

10. Imagine a room that is 26'- 6" x 18'-6", receiving an average Illuminance level of 65-foot candles (FC). How many lumens need to make it to the floor surface? How many fluorescent luminaires housing 3 standard T fluorescent lamps with each lamp giving off 1100 lumens?

4. The Point Calculation Method

Illuminance = Candela value ÷ Distance ^{2}

$E = CD \div D^2$

1. Suppose we have an accent fixture recessed into a 9'- 0" ceiling directly above a sculpture piece 3'- 0"above the finished floor. If the accent fixture has a center beam candlepower (CBCP) of 8,000 candelas, what illuminance level can we expect at the brightest point on the sculpture?

2. Suppose we have an accent fixture recessed into a 12'- 0" ceiling directly above a crystal vase on a pedestal 3'- 6"above the finished floor. If the accent fixture has a center beam candlepower (CBCP) of 10,000 candelas, what illuminance level can we expect at the brightest point on the crystal vase on a pedestal?

3. Suppose we have an accent fixture recessed into a 11'- 6" ceiling directly above a bronze statue 4'- 6"above the finished floor. If the accent fixture has a center beam candlepower (CBCP) of 11,500 candelas, what illuminance level can we expect at the brightest point on the bronze statue?

Candela value needed = Illuminance level desired x distance squared

$CD = E \times D^2$

1. Suppose we have an accent fixture recessed into a 10'- 0" ceiling directly above a sculpture piece 3'- 0"above the finished floor. If we want to illuminate that sculpture piece to 120 foot-candles, what kind of center beam candle power (CBCP) value would we need from the luminaire?

2. Suppose we have an accent fixture recessed into an 11’- 0” ceiling directly above a decorative art glass vase on a pedestal 3’- 0”above the finished floor. If we want to illuminate that decorative art glass vase on a pedestal to 110 foot-candles, what kind of center beam candle power (CBCP) value would we need from the luminaire?