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CERTIFIED LIGHTING EFFICIENCY PROFESSIONAL

CLEP OVERVIEW

ONLINE PROFESSIONAL COURSES LED BY THE WORLD'S TOP SPECIALISTS

ONLINE TRAINING BY KRISHNAJI PAWAR

LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

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MODULE

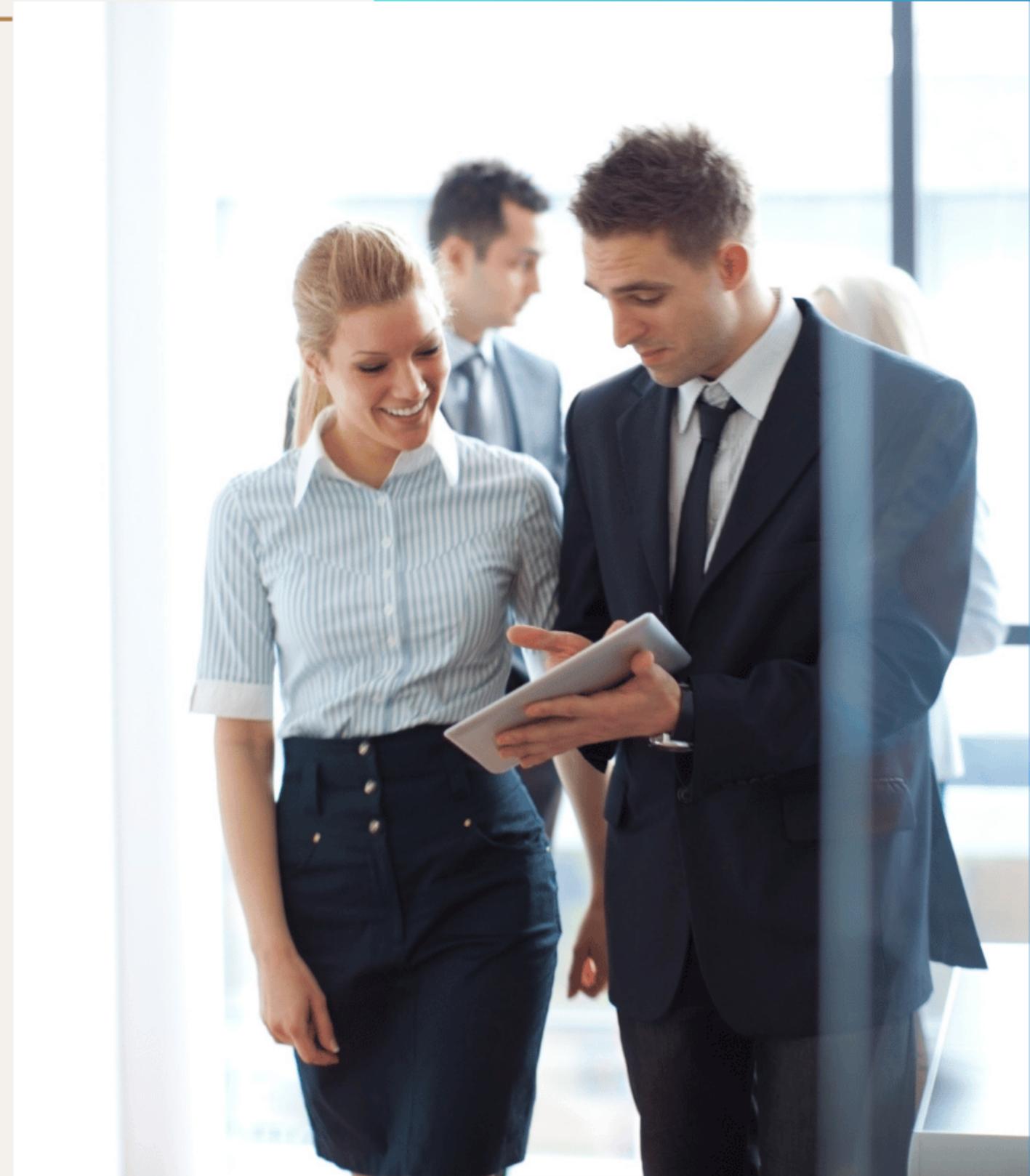
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LED Technology & its Operating Characteristics

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CERTIFIED LIGHTING EFFICIENCY PROFESSIONAL CLEP OVERVIEW

LED technology, a semiconductor device, uses electroluminescence to create light, revolutionizing lighting efficiency and durability. Composed of layers of materials like GaAs, GaP, and GaN, it offers excellent luminous efficacy, thermal management, extended lifespan, and color quality, influenced by materials and packaging design.

Learning Objectives

- Introduction and Course Outline
- Quality Lighting for High-Performance Buildings
- **LED Technology & its Operating Characteristics**
- Lighting Quantity and Quality Fundamentals
- Lighting and control system maintenance and commissioning.
- Environmental Concerns
- Certified Lighting Efficiency Specialist Certification
- Summary and Resources
- CLEP Practice Test V.4.1_Test Your Knowledge



INTRODUCTION

Introduction to LED Technology

- LEDs are semiconductor devices that emit light through electroluminescence.
- They have revolutionized lighting technology due to their efficiency, longevity, and versatility.

Structure of LEDs

- LEDs consist of several layers of semiconductor materials, typically gallium arsenide (GaAs), gallium phosphide (GaP), or gallium nitride (GaN).
- The basic structure includes the P-N Junction, the Active Region, and the encapsulation.



OPERATING CHARACTERISTICS OF LEDs +

LEDs have unique operating characteristics that distinguish them from traditional incandescent and fluorescent lighting sources.

These include:

- Current-Voltage (I-V) Relationship: LEDs have a nonlinear I-V characteristics with a threshold voltage, known as the forward voltage (V_f).
- Efficiency: LEDs are known for their high luminous efficacy, achieving efficacies exceeding 200 lumens per watt.
- Thermal Management: LEDs generate heat during operation, primarily in the form of waste heat at the junction.
- Lifespan and Reliability: LEDs have a significantly longer lifespan compared to traditional light sources, lasting 25,000 to 50,000 hours or more under proper operating conditions.
- Color Quality and Temperature: Both the materials used and the design of the LED package influence the color quality of LEDs.





ENERGY UNITS AND CONVERSIONS

Electricity

Power

1 kW = 1,000 Watts

1 horsepower (hp) = .746 kW

1 Boiler-horsepower (BHP)

= 33,745 Btu/hr

= 9.89 kW

1 watt (W) = 1 Joule/sec (J/sec)

Energy

1 kWh = 3,412 Btu

1 kWh = .03412 therms

1 kWh = .003413 MCF

Pressure

psi = lb/in²

psig = lb/in² gauge measurement

psia = lb/in² gauge measurement plus atmospheric pressure

1 psia = 14.7psi + psig

1 Bar = 14.50 psig

1 psi = 144 lb force/ft²

Air Volume

1 ft³ = 0.07788 lbs at 50degF

1 ft³ = 0.07640 lbs at 60degF

1 ft³ = 0.07495 lbs at 70degF

Lighting

1 foot-candle = 1 lumen/ft²

= approx. 10 lux

Heat Content

1 Btu heats 1 lb water (liquid) by 1°F

1 ton = 12,000 Btu/hr

1 Btu (59 °F) = 1054.80 J

1 kWh = 3.6 x 10⁶ J

1 quad = 1x10¹⁵ Btu

Natural Gas

Energy

1 therm = 100,000 Btu

= 29.31 kWh

1 dekatherm (Dtherm)= 10 therms

= 1,000,000 Btu

= 1 MMBtu

= 1,000 MBtu

Volume

Volume_{therm} = 100 ft³

= 1 CCF

Volume_{Dtherm} = 1000 ft³

= 10 CCF

Water, Steam

1 Gallon water = 8.345 lbs

970 Btu heats 1 lb water (liquid) at 212°F to change state to steam

970 Btu is released from 1 lb steam (vapor) at 212°F to change state to water (liquid)

144 Btu heats 1 lb ice (solid) at 32°F to change state to water (liquid)

144 Btu is released from 1 lb water (liquid) at 32°F to change state to ice (solid)

Water Flow:

500 LB/hr water = 1 gpm water

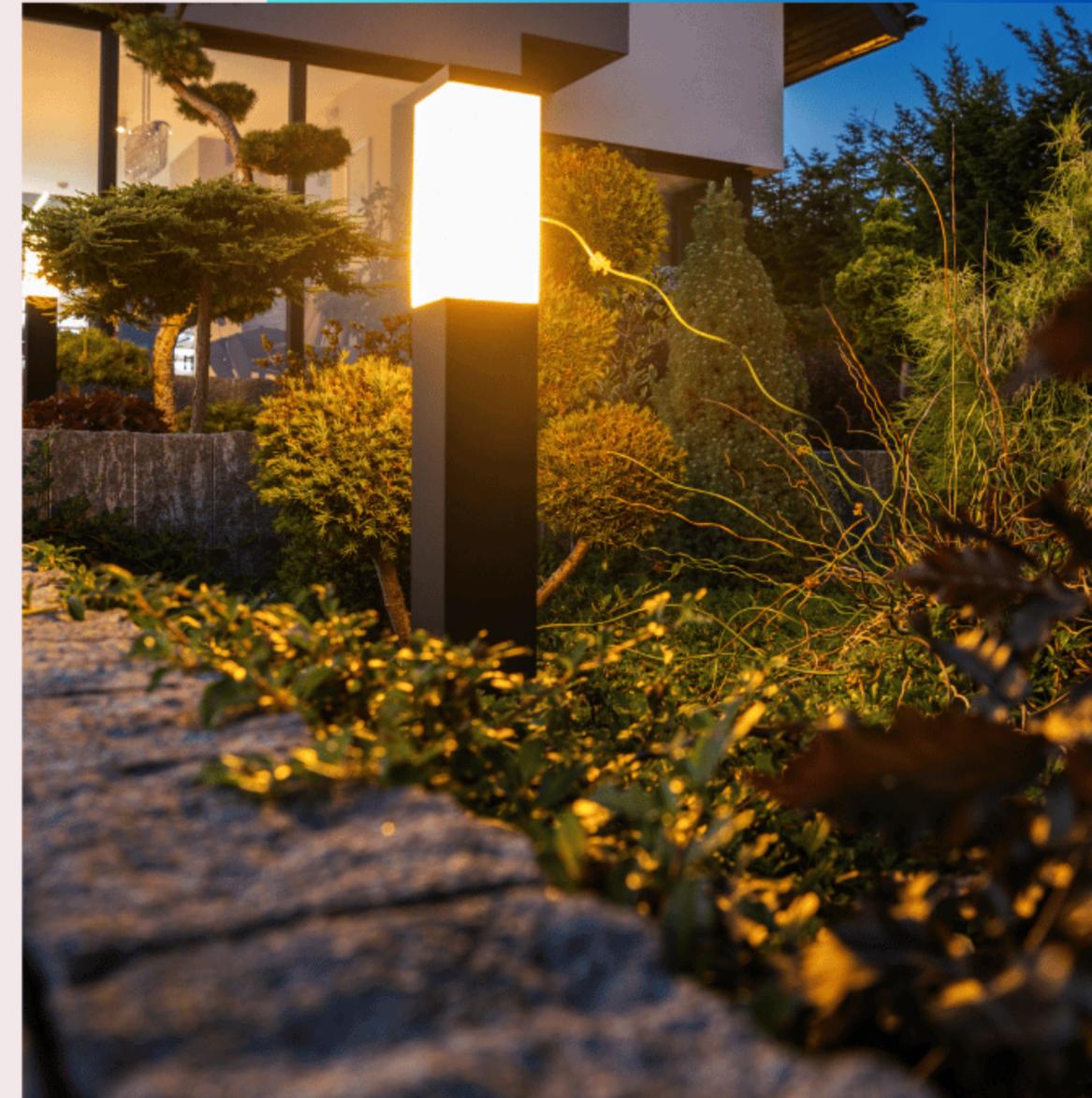
UNDERSTANDING LUMINAIRES AND FIXTURES (L&F)

Introduction to Luminaires and Fixtures

- Luminaires, or fixtures, regulate the distribution of light from various light sources.
- They play a crucial role in lighting design, influencing aesthetic and functional aspects of a space.

Components of a Luminaire

- Light Source: The actual lamp or bulb that produces light.
- Ballast/Driver: Regulates the power supply to the light source.
- Reflectors: Redirect light emitted from the source to enhance efficiency and control distribution.
- Lens or Diffuser: Modifies the light output by spreading it or softening harsh shadows.
- Housing: The structural component that encloses and protects the internal parts of the luminaire.



UNDERSTANDING LUMINAIRES AND FIXTURES (L&F) +

L&F Comparison

- Luminaire Efficiency Factor (LEF): Measures how much light a luminaire emits in comparison to the light source itself.
- Luminaire Efficacy Rating (LER): Provides information about the luminaire's efficacy in terms of lumens produced per watt consumed.
- Coefficient of Utilization (Cu): Measures how effectively a luminaire distributes light throughout a given space.
- Room Cavity Ratio (RCR): A critical parameter for evaluating the lighting design in a given space.





UNDERSTANDING LUMINAIRES AND FIXTURES (L&F) +

Fixture Wiring

- Electrical connections that power a luminaire are referred to as fixture wiring.
- Wiring considerations include voltage drop, load calculations, and compatibility with the fixture's electrical components.



Conclusion

- Understanding luminaires and fixtures (L&F) is essential for effective lighting design and energy management.
- Proper fixture wiring ensures safe and efficient operation, balancing aesthetics, functionality, and energy efficiency.

ENERGY EFFICIENCY IN TRANSPORTATION

Key Factors Affecting Energy Efficiency

- Mode of transport, vehicle technology, aerodynamics and design, operational practices, and infrastructure are key.
- Transition from ICE to EVs significantly influences energy efficiency.
- Efficient operational practices like route optimization, load management, and driving behavior can enhance energy efficiency.
- Infrastructure, including roads, railways, and charging stations, impacts energy efficiency.

Strategies for Enhancing Energy Efficiency

- Government regulations and incentives promote energy efficiency.
- Technological innovation leads to advancements in energy-efficient technologies.
- Consumer behavior, such as public education campaigns, can reduce vehicle miles traveled.
- Integrated transportation systems facilitate seamless transitions between different transport modes.





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THANK YOU

