



University of Sallahadin  
College of Engineering  
Electrical Engineering Dept.



# **Electrical CAD**

## **Lecture Eight**

# **Electrical Installation**

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MSc in Electrical Engineering

# Electrical Installations

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- Consist of
  - Power.
  - Lighting.
  - Backup power system.
  - Fire Alarm system.
  - Sound system.
  - Closed Circuit TV (cctv).
  - Telecommunication system.

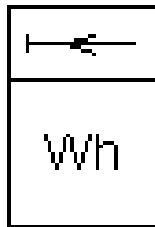
# Power Installations

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- Which consist all required components to operate devices and machines inside and outside a building.

# Electrical meter

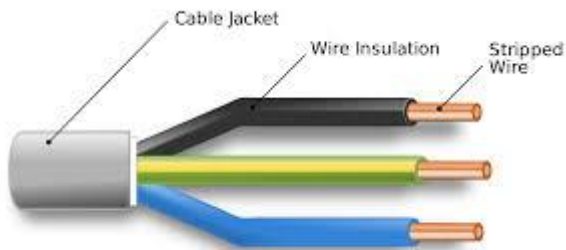
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# Cables

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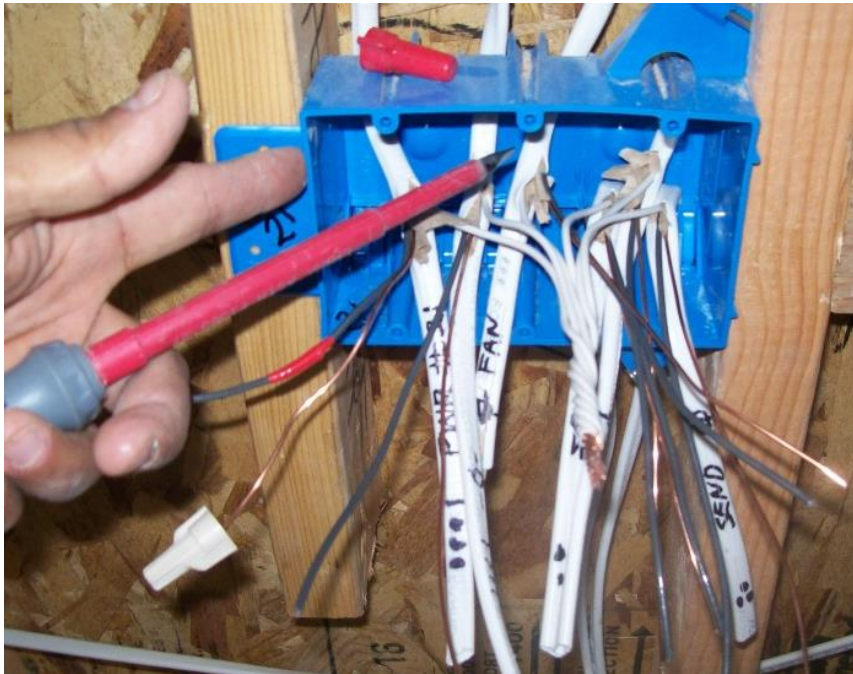
- Type of Cables:
  - Romex.
  - Single Core.
  - Multi Core Cable.



# Cabling

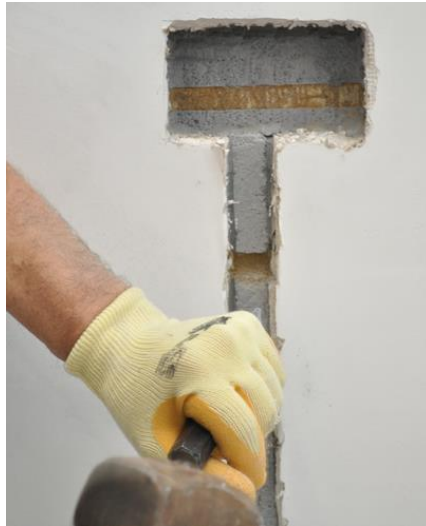
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- Romex.



# Cabling

- Single Core and conduit pipe.



# Cabling

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Cables enclosed in an insulated wall

| Cable size | Rating in Amps |
|------------|----------------|
| 1mm        | 11             |
| 1.5mm      | 14             |
| 2.5mm      | 18.5           |
| 4.00mm     | 25             |
| 6.00mm     | 32             |
| 10.00mm    | 43             |

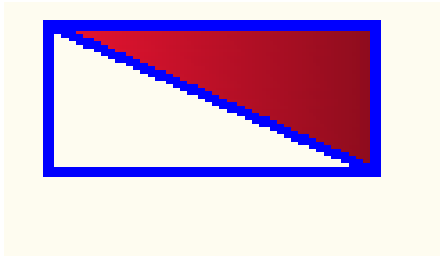
Cables which are clipped direct

| Cable size | Rating in Amps |
|------------|----------------|
| 1mm        | 15             |
| 1.5mm      | 19.5           |
| 2.5mm      | 27             |
| 4.00mm     | 36             |
| 6.00mm     | 46             |
| 10.00mm    | 63             |



# Circuit Breaker

- In general are mounting in the middle of building.
- Miniature Circuit Breaker.
- 10A, 20, 25, 32, 40A



# Socket Outlets

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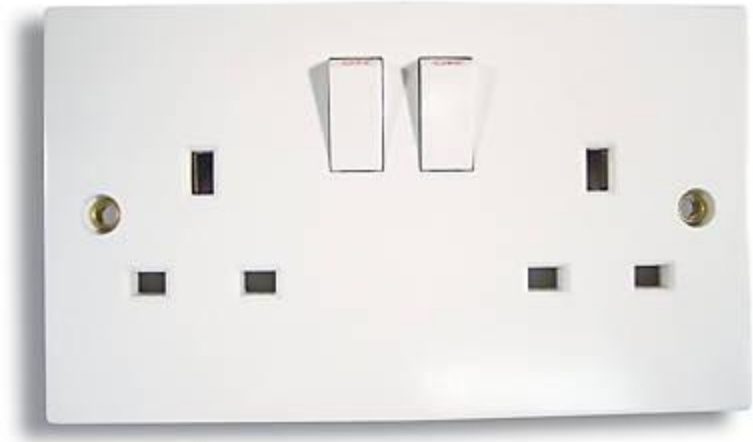
- Single Socket: 220V, 13A.



# Socket Outlets

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- Double Socket: 220V, 13A.



# Socket Outlets

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- Power Socket: 220V, 15A.



# Socket Outlets

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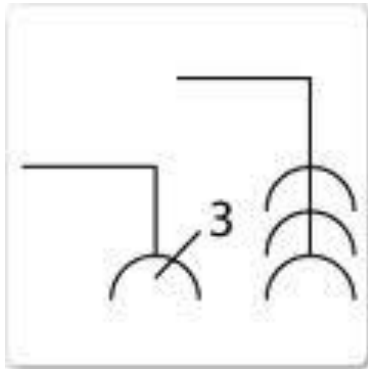
- Weather Proof Socket: 220V, 13A.



# Socket Outlets

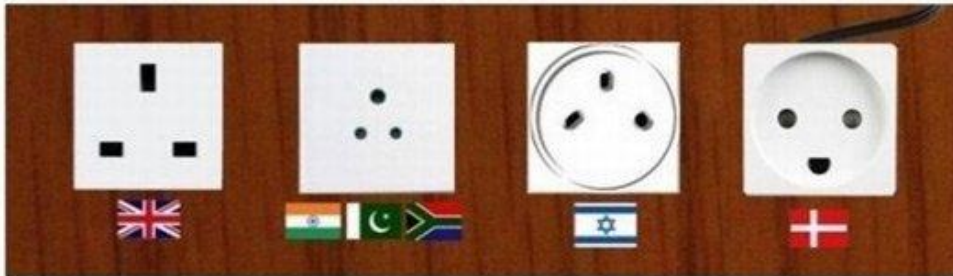
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- 3 Phases Socket: 380V, 16A to 100A.



# Socket Outlets

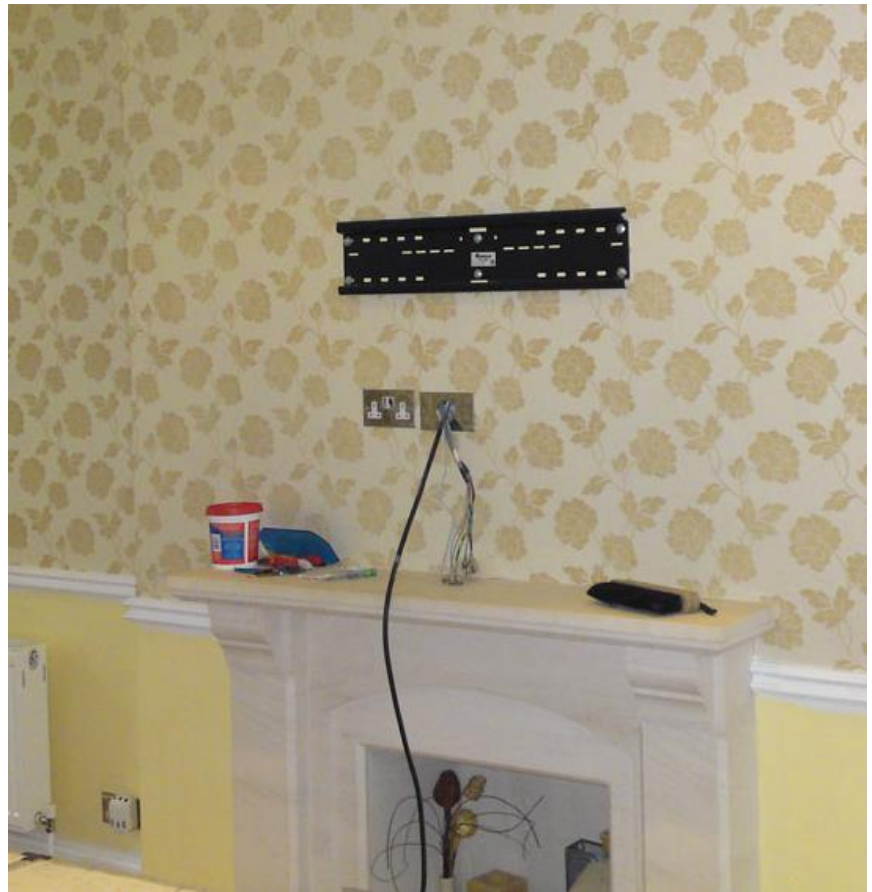
- World wide socket outlets.



# Socket Outlets Mounting

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- Wall Mounting: 30cm or 120cm.





# Socket Outlets Mounting

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- Floor Mounting.



# Socket Outlets Mounting

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- Furniture Mounting.



# Socket Outlets Mounting

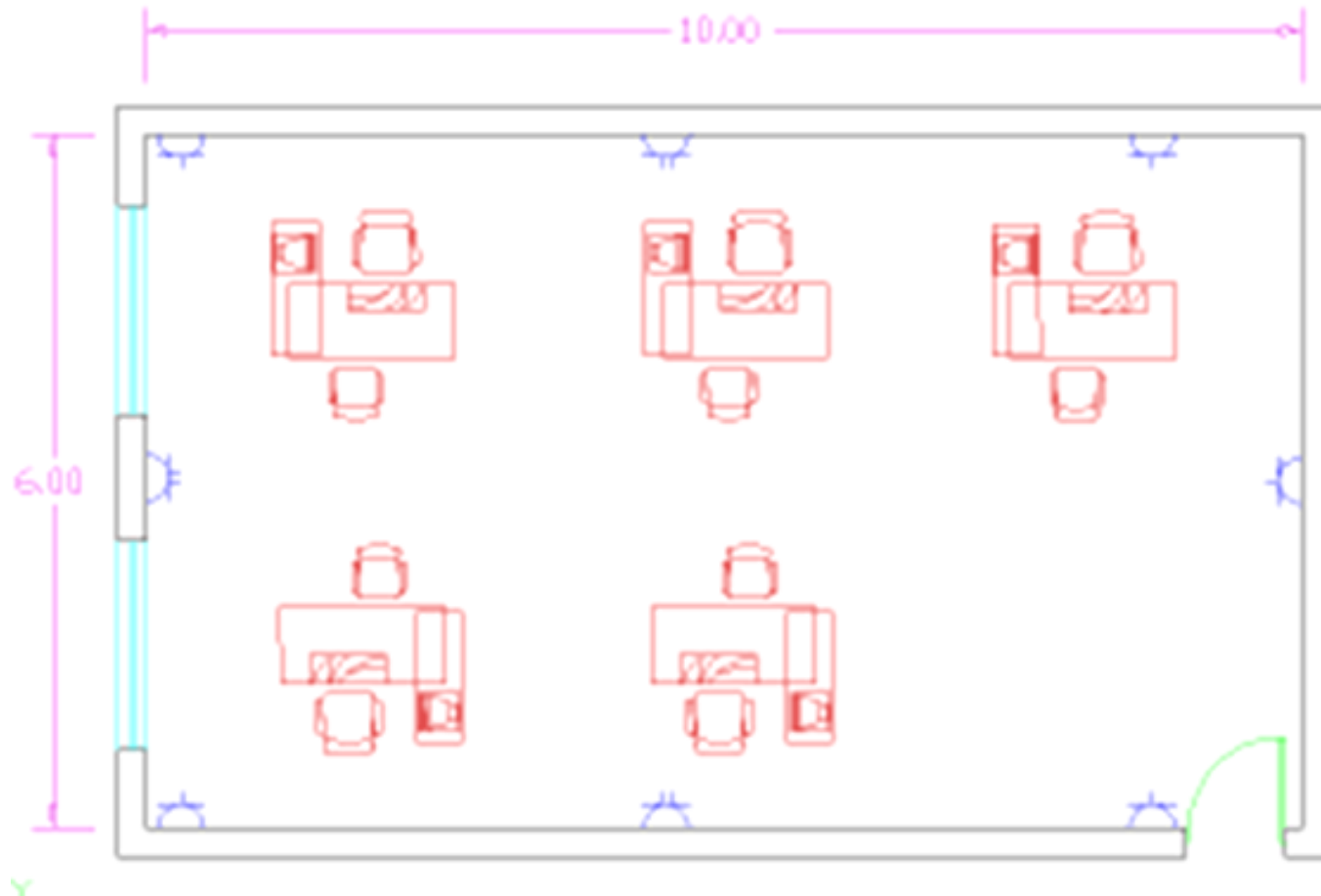
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- Column Socket Outlets: in admin buildings.



# Socket Outlets Distribution

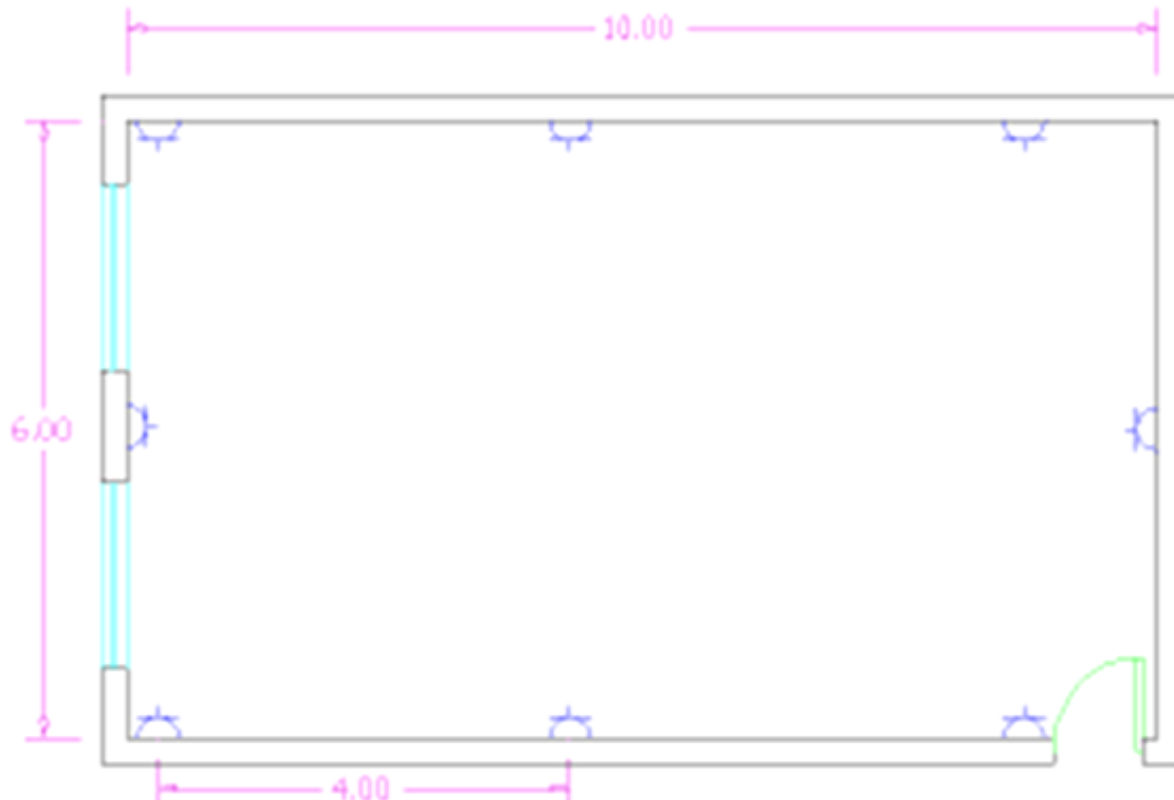
- Per furniture distribution.



# Socket Outlets Distribution

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- Standards
  - Inside Rooms: 4m distance
  - Outside Rooms: 6m distance



# Electrical Lighting Installations

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- Which consist all required components to light inside and outside a building.

# Definitions

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## Electric power

- The electric power is the power consumed by a light source.

## Brightness / Luminous flux / luminous efficiency

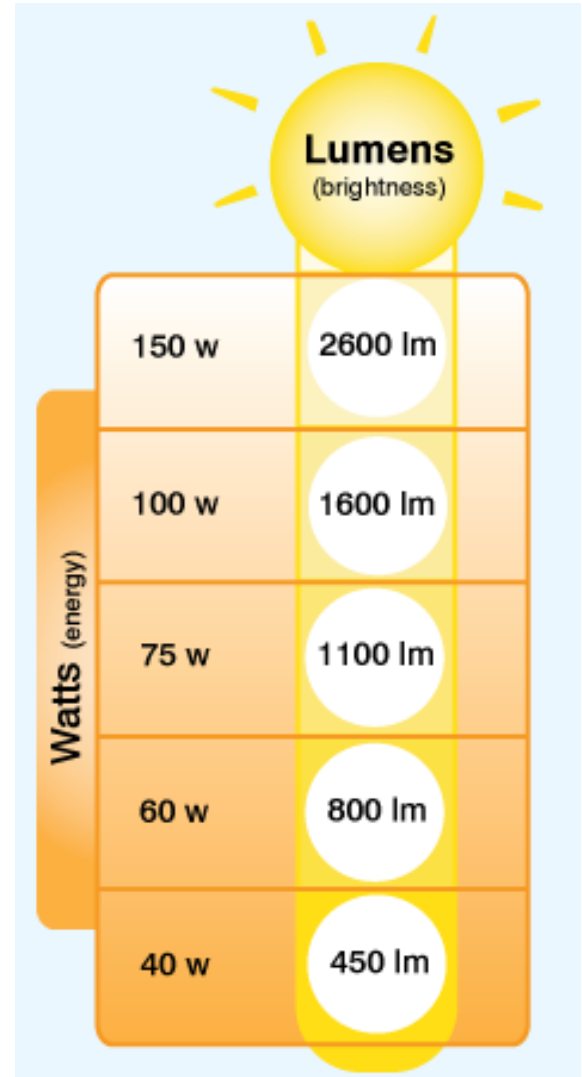
- Luminous flux defines the total quantity of light emitted from a light source.
- The unit used is the lumen [lm].
- The ratio of luminous flux to the required electric power gives the luminous efficiency [lm/W].

# The most common light sources

## Incandescent lamp



- Typical lamps for household use
- Range from about 40 to 150 W
- Typical efficiency of about 12%.
- Screw or bayonet

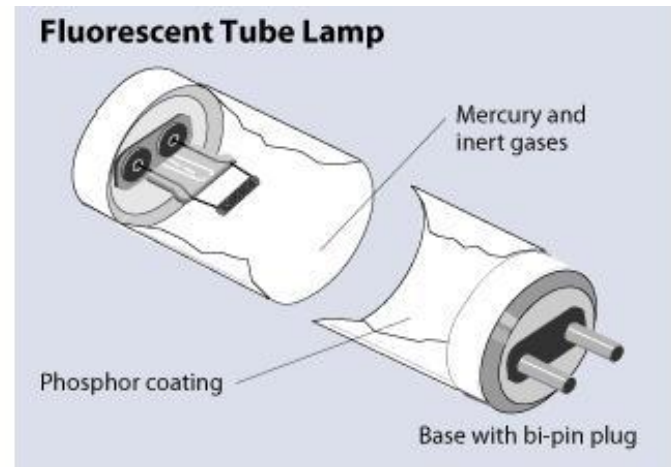




# The most common light sources

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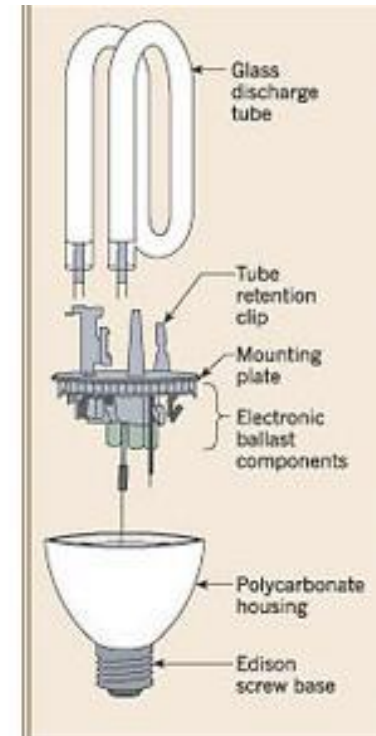
## Fluorescent tube



- For offices and commercial buildings.
- The tube contains mercury vapour at low pressure.
- The inner wall of the glass is coated with a phosphor.
- Can achieve a luminous efficacy of up to 104 lm/W

# The most common light sources

## Compact fluorescent lamp (CFL)



- Use: Domestic and commercial areas.
- High luminous efficiency
- Dimmable
- screw or bayonet

# The most common light sources

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## Halogen lamps



12 V

230 V

- Use: Domestic areas, hospitality and decorative applications
- Service life and luminous better than incandescent lamps.
- Dimmable

# The most common light sources

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## Metal halide lamps



- Use: industrial bays and retail areas
- High luminous efficiency
- Usually not dimmable

# The most common light sources

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## High-pressure sodium discharge lamps

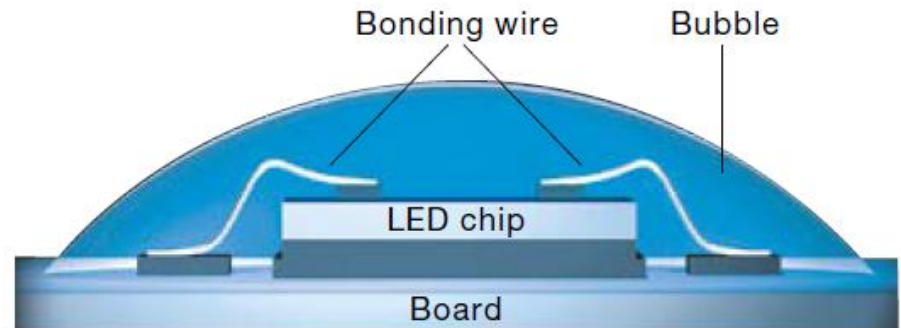


- Use: industrial bays, street lighting, outdoor illumination
- High luminous efficiency and long service life
- Yellowish light color
- Can be dimmed in steps

# The most common light sources

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## Light emitting diodes (LEDs)



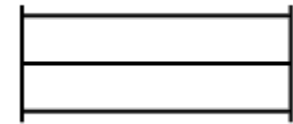
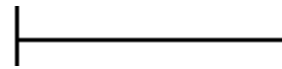
- Use: LEDs can be used for functional and decorative lighting.
- Very efficient light production
- Can be switched and dimmed as required
- Very long service life
- Very good production of colored light

# Electrical Lighting Components

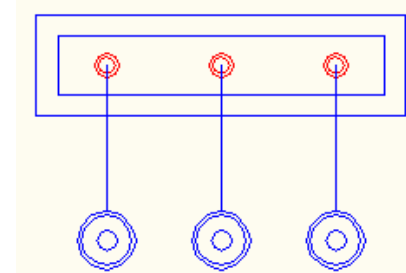
Spot light



Fluorescent tube



Decorative light



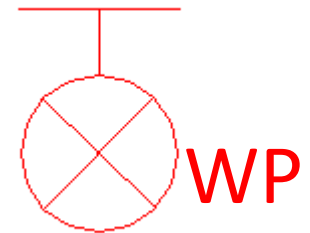
# Electrical Lighting Components

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## Wall mounted light



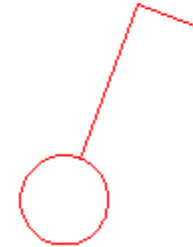
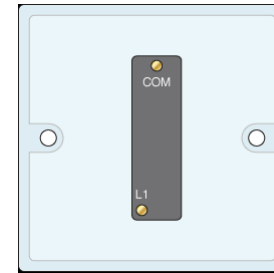
## Outdoor wall mounted light



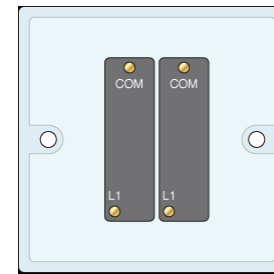


# Electrical Lighting Components

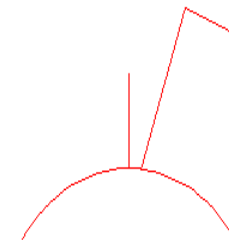
## One way one gang switch



## One way two gangs switch

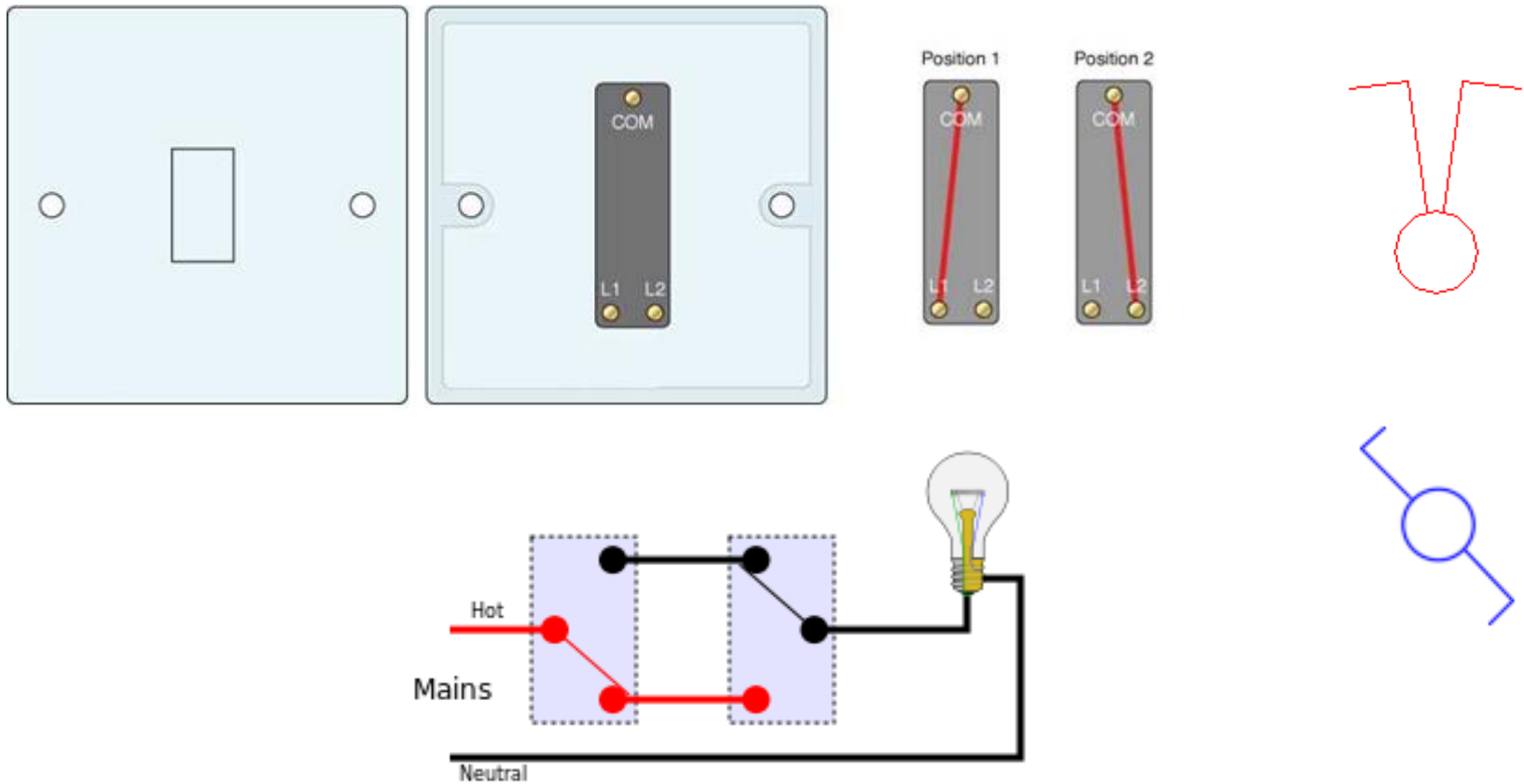


## One way one gang switch with socket outlet



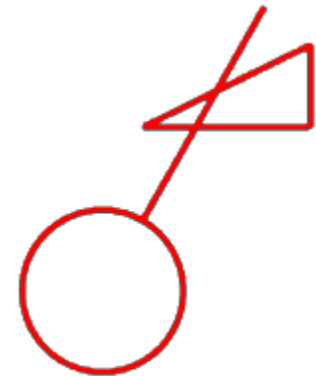
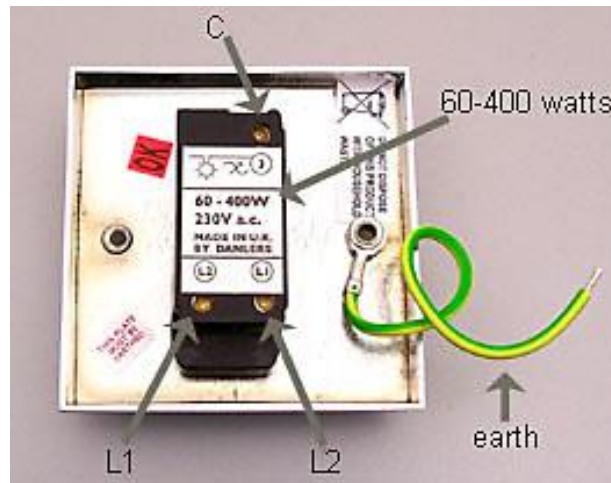
# Electrical Lighting Components

## Two way one gang switch

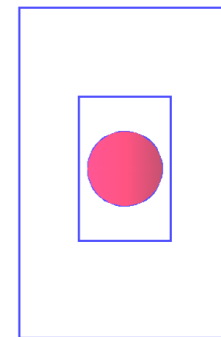


# Electrical Lighting Components

## Dimmer switch



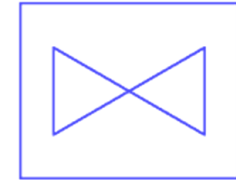
## Push button switch



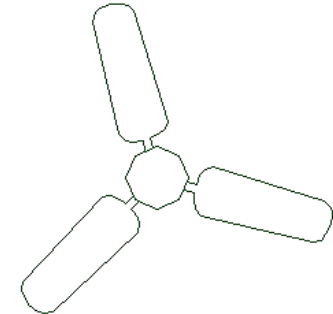
# Some other electrical

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Exhaust fan



Ceiling fan



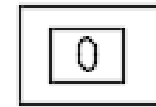
Bell Ring



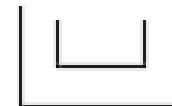
# Some other electrical

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Intercom



TV SOCKET



Wire less modem



# LEGEND

| LEGEND  |  |
|---|--|
|    | Lighting and Small Power Distribution Board    |
|    | 18 W LED Spot Lighting Fixture                 |
|    | 12 W LED Spot Lighting Fixture                 |
|    | 18 W LED Spot Lighting Fixture water proof     |
|    | 12 W LED Spot Lighting Fixture water proof     |
|    | 50W Recessed Type Lighting Fixture             |
|    | 1x20W LED Decorative Lighting Fixture          |
|    | SOCKET 13 A                                    |
|   | 45 A FOR SPLIT AND BOILER                      |
|  | E-60W Wall Type Lighting Fixture (Water Proof) |
|  | One Gang switch 230V, 10A                      |
|  | Two & three Gang switch 230V, 10A              |
|  | One Gang Two-way Switch 230V, 10A              |
|  | Intercom                                       |
|  | TV SOCKET                                      |
|  | wire less modern                               |
|  | TV antena & Dish sattalite                     |

# Recommended Lighting Levels

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| Building Type                   | Space Type                    | Average Illuminance level (lux) |
|---------------------------------|-------------------------------|---------------------------------|
| Houses<br>Hotels<br>Restaurants | Sitting room                  | 400                             |
|                                 | Dining room                   | 100                             |
|                                 | Kitchen                       | 500                             |
|                                 | Corridor                      | 50                              |
|                                 | Stairs                        | 50                              |
|                                 | Washrooms, bathrooms, toilets | 300                             |
|                                 | Bedrooms                      | 300                             |
| Educational Buildings           | Play room, nursery, classroom | 400                             |
|                                 | Lecture hall                  | 400                             |
|                                 | Computer practice rooms       | 30                              |

# Recommended Lighting Levels

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| Building Type    | Space Type                | Average Illuminance level (lux) |
|------------------|---------------------------|---------------------------------|
| Office buildings | Single offices            | 400                             |
|                  | Conference rooms          | 300                             |
| Hospitals        | General ward lighting     | 300                             |
|                  | Simple examination        | 500                             |
|                  | Examination and treatment | 1000                            |
| Sport facilities | Sports halls              | 300                             |
| Industrial       | Metal working/ welding    | 300                             |
|                  | Simple Assembly           | 300                             |
|                  | Difficult Assembly        | 1,000                           |
|                  | Exacting Assembly         | 3,000                           |



# Lighting Calculations

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$$N = \frac{\text{lux} \times \text{length} \times \text{width}}{n \times \text{UF} \times \text{lum}}$$

- N : Number of luminaries in the room  
lux : Required lux (lux)  
length : Room length (m)  
width : Room width (m)  
n : Number of lamps in each luminaries  
UF : Utilization factor = 0.5  
lum : Lamp Brightness or Luminous flux (lm)

$$\text{Number in Length} = \sqrt{\frac{L \times N}{W}} \quad \text{Number in Width} = \sqrt{\frac{W \times N}{L}}$$

# Lighting Distribution

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- Room type: Office then required lux= 400
- Dimensions: 10 X 6 m<sup>2</sup>
- Use: 2 x 30W CFL with lumens 2010 lm (1W gives 67 lm)

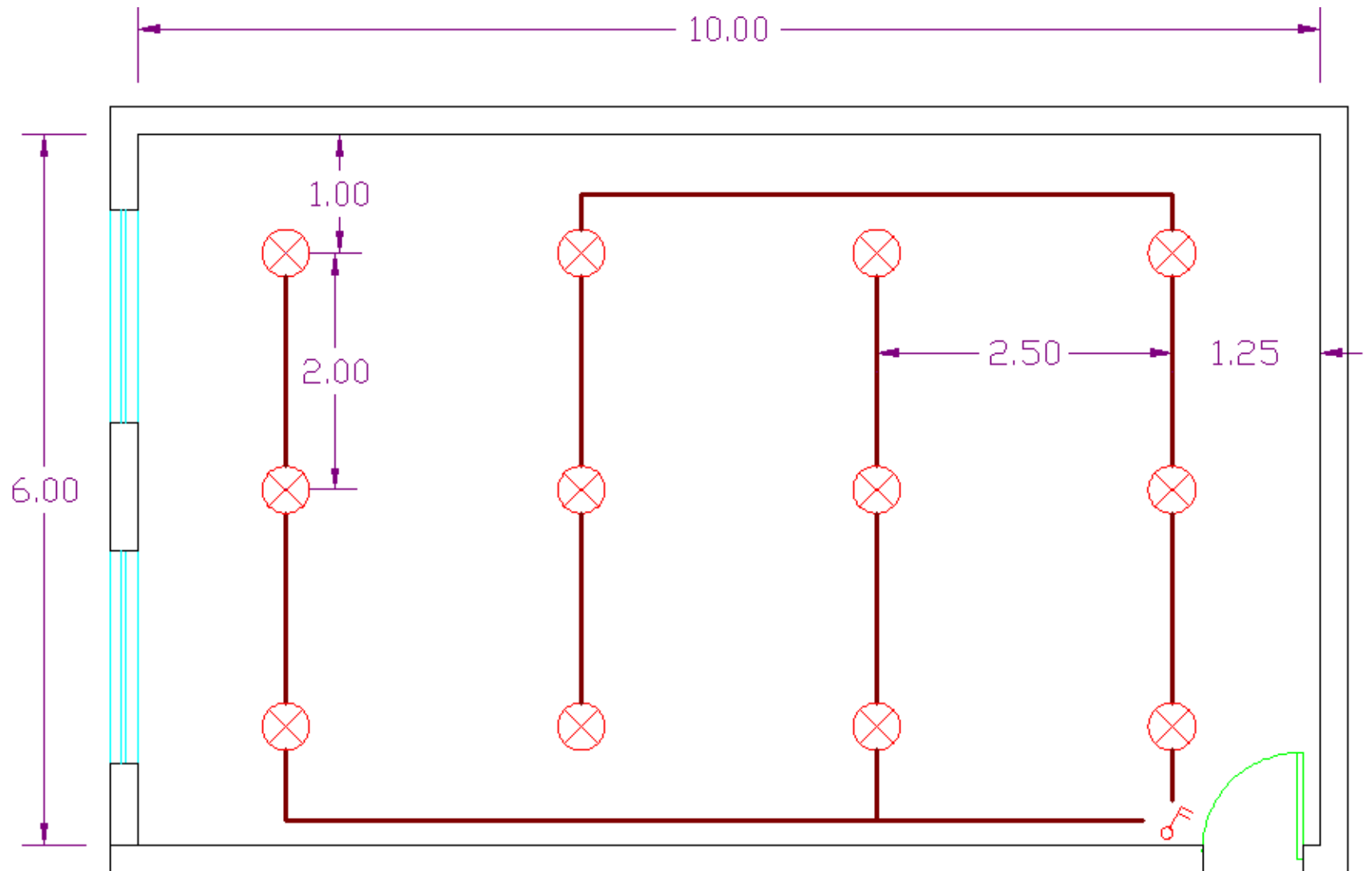
$$N = \frac{400 \times 10 \times 6}{2 \times 0.5 \times 2010} = 12$$

$$N \text{ in Width} = \sqrt{\frac{6 \times 12}{10}} = 2.68 \approx 3 \quad N \text{ in Length} = \sqrt{\frac{10 \times 12}{6}} = 4.47 \approx 4$$

$$\text{Width Space} = \frac{6 \text{ m}}{3} = 2 \text{ m}$$

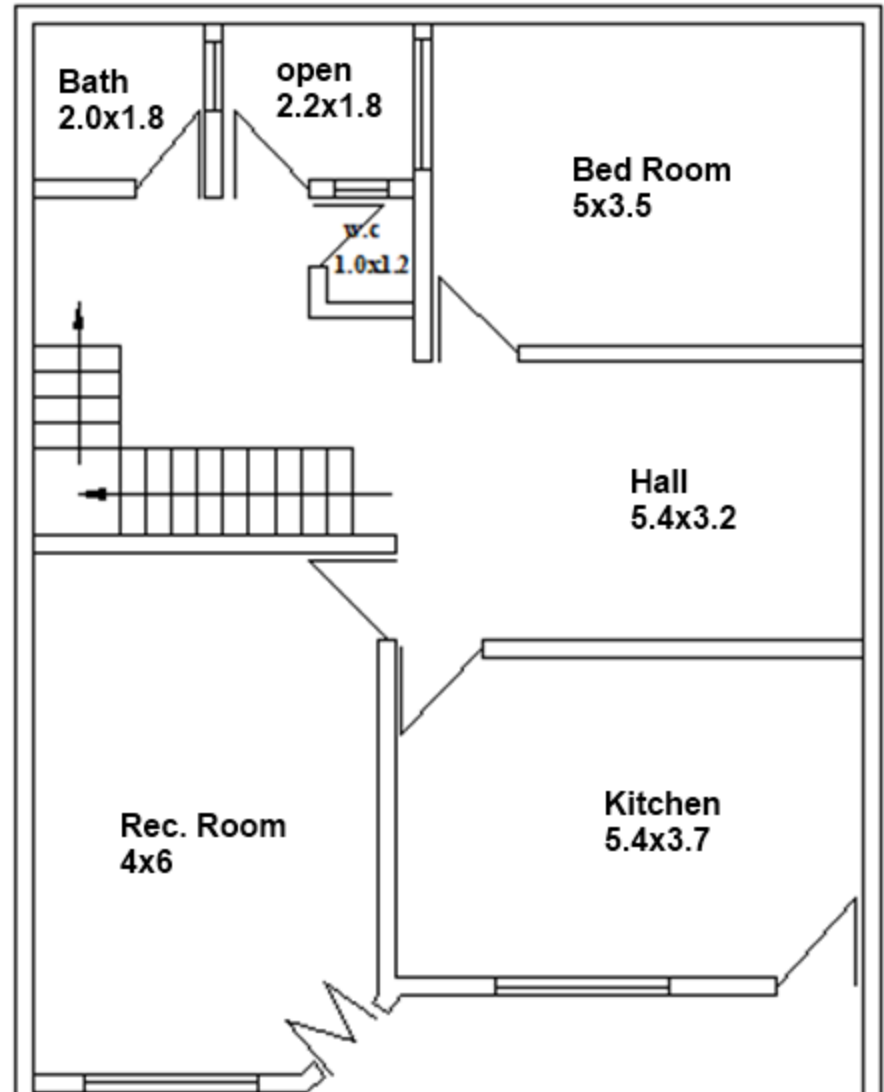
$$\text{Length Space} = \frac{10}{4} = 2.5 \text{ m}$$

# Lighting Distribution



# Assignment

- Provide shown building with proper electrical power and lighting installation using AutoCAD.



# Questions and Thank you

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*Thank  
you*