



**UNIVERSITY OF
CALGARY**

ENEL 674 Industrial and Commercial Power Systems

Group 7

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Project Milestone 1

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1) General calculation instructions:

- Calculation according to scale that is given in the base DWG file.
- Calculated length, width and area in the attached excel sheet.
- All the calculations are in the excel sheet. We have used the Canadian electrical code (CEC) for our reference.
- Calculation is done based on the demand factor. In each case demand factor is different and it is attached with this.
- All the 20A receptacles are T slots type as per NEMA 5-20R.
- Ceiling heights and cavity heights are mentioned in the sheet for our calculation.
- All different parameters like LLF (=0.85), RCR, reflectance (Ceiling, Wall & Floor) and co-efficient of utilization are considered in calculation of luminaires.
- Average lux (or footcandle) is considered as per the category of the room. All the calculations of the light luminaires are based on the specification list of the manufacturer.
- Mostly, Daylight type of the lights have been used in the design.
- For most of the part, T-bar lights, suspended lights and recessed lights are used in the design.
- For the layout plan, same scale is used for the light mounts, CCTV and smoke detector.
- Recommendations and suggestions are mentioned where needed.
- In the design, 16.66 kVA load demand is assumed in future. So, spare circuits are provided accordingly.

2) Room wise detailed calculations and details:

Room 100: Foyer

- Area = 61.44 Sq Feet
- Required lux = 200 lux
- Required Lumens = 4332.42
- Type of Light = Wall mounted luminaire
- No of Receptacles = 2
- Force flow fan = 720 W
- CCTV rating = 6 W

Above specifications are our best match for the design. This is the official entrance of a building. Force Flow Fan is used at the entrance to prevent the infiltration of outside air with inside air. Receptacle 41 is given for the housekeeping purpose. Luminaire 40 is an emergency Light. CCTV #11 is used for surveillance and powered by emergency supply.

Recommendations/Suggestions: This is fire fighters access point. Measurable clearance should be required as per the safety guidelines and on top of that fire lane must be designed. In addition, muster point should be decided as well.

Room 101: Classroom

- Area = 346.08 Sq Feet
- Required lux = 500 lux
- Required Lumens = 22602.43
- Type of Light = Recessed luminaire
- No of Receptacles = 8
- Projector = 429 W
- CCTV rating = 6 W

Above specifications are our best match for the design. Specific acoustic levels should be considered. Receptacles 55, 57 and 58 are duplex type ceiling mounted. Receptacles 45 and 66 are given for the housekeeping purpose.

Room 102: Closet

- Area = 27.52 Sq Feet
- Required lux = 108 lux
- Required Lumens = 928.14
- Type of Light = Strip luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Receptacle 68 is given for the housekeeping purpose.

Room 103: Women's Washroom

- Area = 183.68 Sq Feet
- Required lux = 200 lux
- Required Lumens = 10222.89
- Type of Light = Recessed luminaire
- No of Receptacles = 2 (GFCI type)
- Hand dryer: 500 W

Above specifications are our best match for the design. Receptacle 71 is given for the housekeeping purpose and Receptacle 73 is of GFCI type. Luminaire 70 is an emergency Light.

Recommendations/Suggestions: Mechanical exhaust fan should be placed.

Room 104: Men's Washroom

- Area = 114.56 Sq Feet
- Required lux = 200 lux
- Required Lumens = 7244.24
- Type of Light = Recessed luminaire
- No of Receptacles = 2 (GFCI type)
- Hand dryer: 500 W

Above specifications are our best match for the design. Receptacle 72 is given for the housekeeping purpose and Receptacle 77 is of GFCI type. Luminaire 77 is an Emergency Light.

Recommendations/Suggestions: Mechanical exhaust fan should be placed.

Room 105: Washroom Corridor

- Area = 40.32 Sq Feet
- Required lux = 200 lux
- Required Lumens = 1546.28
- Type of Light = Recessed luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Receptacle 80 is given for the housekeeping purpose and Washroom signage is also provided outside the washroom corridor.

Room 106: Janitor

- Area = 24.96 Sq Feet
- Required lux = 250 lux
- Required Lumens = 1196.52
- Type of Light = Surface Mounted Luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Receptacle 81 is of GFCI type and given for the housekeeping purpose.

Room 107: Water Meter Entrance

- Area = 15.63 Sq Feet
- Required lux = 108 lux
- Required Lumens = 527.10
- Type of Light = Strip luminaire
- No of Receptacles = 2
- Forced Flow Fan = 720 W

Above specifications are our best match for the design. Force Flow Fan is used at the entrance of Water Meter Room to prevent the infiltration of outside air with inside air. Receptacle 78 is given for the housekeeping purpose. Entry to this room required special access.

Room 108: Catering Kitchenette

- Area = 398 Sq Feet
- Required lux = 325 lux
- Required Lumens = 19399.36
- Type of Light = Suspended Luminaire
- No of Receptacles = 10
- Baseboard Heater = 3500 W

Above specifications are our best match for the design. Receptacles 84 and 95 are given for the housekeeping purpose. Receptacle 82 is of GFCI type. Direct supply is provided to following: Dishwasher, Electric Range, Chimney, Exhaust fan, Fridge, Oven. Receptacle 95 is provided for digital display board. Luminaire 84 is Emergency Light.

Room 109: Commons

- Area = 1119.89 Sq Feet
- Required lux = 215 lux
- Required Lumens = 48718.61
- Type of Light = Recessed luminaire
- No of Receptacles = 28
- CCTV = 12 W
- Baseboard Heater = 5500 W
- Projectors = 858 W (Qty: 2)

Above specifications are our best match for the design. Receptacles 18,36,97,85 and 92 are given for the housekeeping purpose. Exit signage is fed from Emergency Supply to help people in directing towards exit in case of any emergency. Luminaire 14, 43, 54, 69,84 are Emergency Light.

Room 110: Cultural Activity Room

- Area = 1171.28 Sq Feet
- Required lux = 215 lux
- Required Lumens = 29818.22
- Type of Light = Strip luminaire
- No of Receptacles = 28
- CCTV = 12 W
- Baseboard Heater = 5000 W
- Projectors = 858 W (Qty: 2)

Above specifications are our best match for the design. Receptacles 70,75,79,86,93 and 94 are given for the housekeeping purpose. Exit signages are fed from Emergency Supply to help people in directing towards exit in case of emergency.

Room 111: Storage

- Area = 89.98 Sq Feet
- Required lux = 108 lux
- Required Lumens = 2123.37
- Type of Light = Strip luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Receptacles 52 and 62 are given for the housekeeping purpose.

Room 112: Snack Preparation Room

- Area = 94.97 Sq Feet
- Required lux = 215 lux
- Required Lumens = 3849.15
- Type of Light = Strip luminaire
- No of Receptacles = 6

Above specifications are our best match for the design. Receptacles 60 is provided for housekeeping purpose. Receptacles 64 and 65 are of GFCI type.

Room 113: Information/Gift Shop

- Area = 257.56 Sq Feet
- Required lux = 330 lux
- Required Lumens = 16017.49
- Type of Light = Suspended luminaire
- No of Receptacles = 14
- CCTV = 12 W

Above specifications are our best match for the design. Receptacles 42,48 and 59 are provided for housekeeping purpose. Luminaire 41 is Emergency Light.

Room 114: Storage

- Area = 17.51 Sq Feet
- Required lux = 108 lux
- Required Lumens = 590.56
- Type of Light = Strip luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Receptacles 51 is provided for housekeeping purpose.

Room 115: Yukata

- Area = 78.62 Sq Feet
- Required lux = 50 lux
- Required Lumens = 1227.53
- Type of Light = Strip luminaire
- No of Receptacles = 5

Above specifications are our best match for the design. Receptacles 51 is provided for housekeeping purpose.

Recommendations/Suggestions: Humidifier and dehumidifiers are suggested in this place.

Room 116: Education Office

- Area = 150.44 Sq Feet
- Required lux = 480 lux
- Required Lumens = 10065.71
- Type of Light = Suspended luminaire
- No of Receptacles = 4

Above specifications are our best match for the design. Receptacles 30 is provided for housekeeping purpose.

Room 117: Mechanical Room

- Area = 81.70 Sq Feet
- Required lux = 200 lux
- Required Lumens = 4699.57
- Type of Light = Surface mount luminaire
- No of Receptacles = 3
- Forced Flow Fan = 1500 W
- Furnace 1 = 3439.48 W
- Furnace 2 = 3439.48 W
- Fire Pump = 20 HP

Above specifications are our best match for the design. Receptacles 20 and 29 are provided for housekeeping purpose. Force Flow Fan is used at the entrance of Mechanical Room 117 to prevent the infiltration of outside air with inside air. Luminaire 25 is Emergency Light. In addition to that, 20HP fire pump is placed in here as well. Fire-pump is used for sprinklered protection. Entry is restricted to staff only via staff ID/Pin pad as per the requirement.

Recommendations/Suggestions: Exhaust fan might be additional advantage in here in case of any emergency.

Room 118: Staff Lockers

- Area = 93.47 Sq Feet
- Required lux = 100 lux
- Required Lumens = 2500.27
- Type of Light = Strip luminaire
- No o Receptacles = 4

Above specifications are our best match for the design. Receptacles 21 is provided for housekeeping purpose.

Room 119: Administration Office

- Area = 154.56 Sq Feet
- Required lux = 470 lux
- Required Lumens = 10090.77
- Type of Light = Suspended luminaire
- No of Receptacles = 4

Above specifications are our best match for the design. Receptacles 39 is provided for housekeeping purpose.

Room 120: Vestibule

- Area = 49.28 Sq Feet
- Required lux = 125 lux
- Required Lumens = 1923.64
- Type of Light = Recessed luminaire
- No of Receptacles = 2
- Forced Flow Fan = 1500 W

Above specifications are our best match for the design. Force Flow Fan is used at the entrance to prevent the infiltration of outside air with inside air. Receptacles 14 is provided for housekeeping purpose. Luminaire 10 is Emergency Light. Entry is restricted to staff only via staff ID/Pin pad as per the requirement.

Room 121: Classroom

- Area = 346.08 Sq Feet
- Required lux = 500 lux
- Required Lumens = 22602.43
- Type of Light = Recessed luminaire
- No of Receptacles = 8
- Projector = 429 W
- CCTV rating = 6 W

Above specifications are our best match for the design. Receptacles 10 and 19 are provided for housekeeping purpose.

Room 122: Exhibit Gallery

- Area = 287.36 Sq Feet
- Required lux = 800 lux
- Required Lumens = 36808.76
- Type of Light = Recessed luminaire
- No of Receptacles = 12
- Projector = 429 W

Above specifications are our best match for the design. Receptacles 22,28 and 24 are provided for housekeeping purpose.

Room 123: Tea Ceremony

- Area = 71.14 Sq Feet
- Required lux = 180 lux
- Required Lumens = 3998.72
- Type of Light = Recessed luminaire
- No of Receptacles = 4

Above specifications are our best match for the design. Receptacles 38 is provided for housekeeping purpose.

Room 200: Stairwell

- Area = 60.16 Sq Feet
- Required lux = 250 lux
- Required Lumens = 4566.22
- Type of Light = Wall mounted luminaire
- No of Receptacles = 2

Above specifications are our best match for the design. Entry is restricted to staff only via staff ID/Pin pad as per the requirement.

Room 202: Electrical Room

- Area = 138.72 Sq Feet
- Required lux = 220 lux
- Required Lumens = 5429.99
- Type of Light = Recessed luminaire
- No of Receptacles = 4

Above specifications are our best match for the design. Receptacles 3 is provided for housekeeping purpose. Luminaire 2 is Emergency Light.

Recommendations/Suggestions: According to our design, we require at least 300 sq feet room size to accommodate everything. We are having some safety and heating concerns right now with this design. We need more spacing between the panels. And issues with conductor bending due to size of the conductors. Ventilation and cooling are additional advantage. We are planning to install UPS, that will require isolated space for battery bank.

Room 203: Mechanical Room

- Area = 294.98 Sq Feet
- Required lux = 220 lux
- Required Lumens = 8892.43
- Type of Light = Surface mount luminaire
- No of Receptacles = 6
- Domestic Hot Water Tank = 600 W
- Exhaust Fan = 186.42 W
- Furnace 3 = 3494.18 W

- Furnace 4 = 4193.38 W

Above specifications are our best match for the design. Receptacles 2 and 5 are provided for housekeeping purpose. Luminaire 3 is Emergency Light.

Room 204: Telecom Room

- Area = 158.87 Sq Feet
- Required lux = 220 lux
- Required Lumens = 5976.36
- Type of Light = Recessed luminaire
- No of Receptacles = 6

Above specifications are our best match for the design. Receptacles 6 and 8 are provided for housekeeping purpose. Luminaire 6 is Emergency Light.

Recommendations/Suggestions: Limited access should be there. CCTVs and telecommunication panels are there. Access of security system should be restricted to staff only via staff ID/Pin pad as per the requirement.

3) Future Scope:

- Digital access control of lighting system.
- Motion sensor light controls in washrooms.
- Communication layouts and equipment (Wi-Fi) layout.
- Exit signage that will work on emergency power supply in each room.
- Fire alarm layout and other devices layouts.
- UPS design, rating and co-ordination with renewable energy.
- Dimming control unit is required.
- Various power system analysis.