Bangladesh University of Engineering and Technology
Department of Electrical &Electronic Engineering

Course No. EEE414

Course Name: Electrical Service Design

Project: 3-Storey Building Design

Group-7

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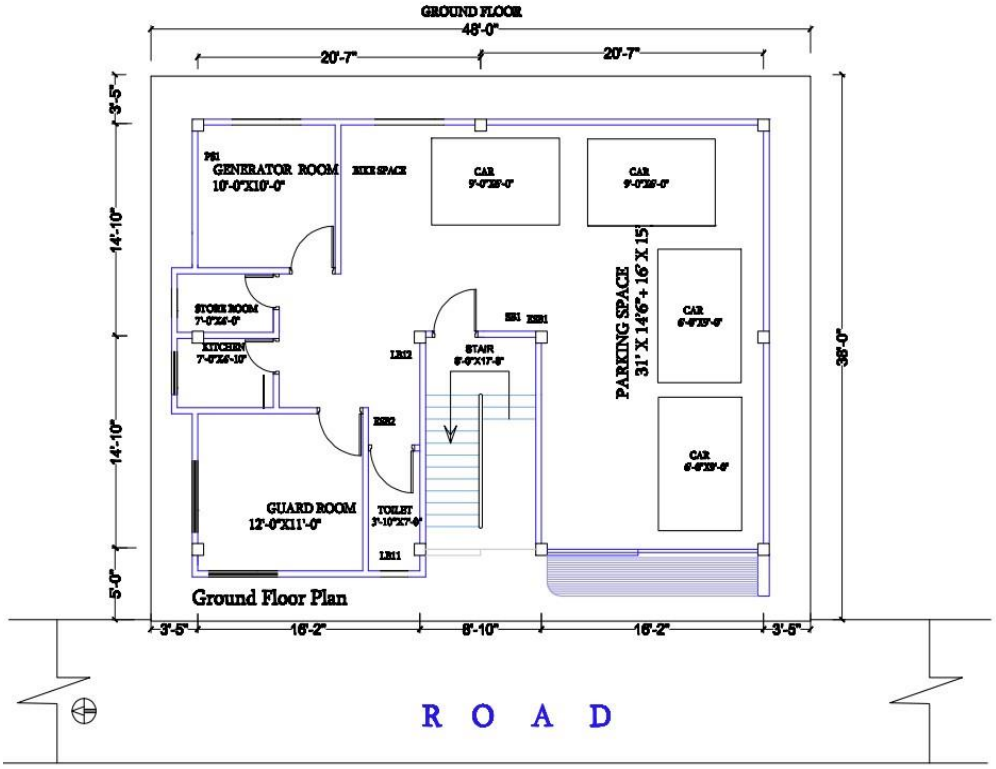
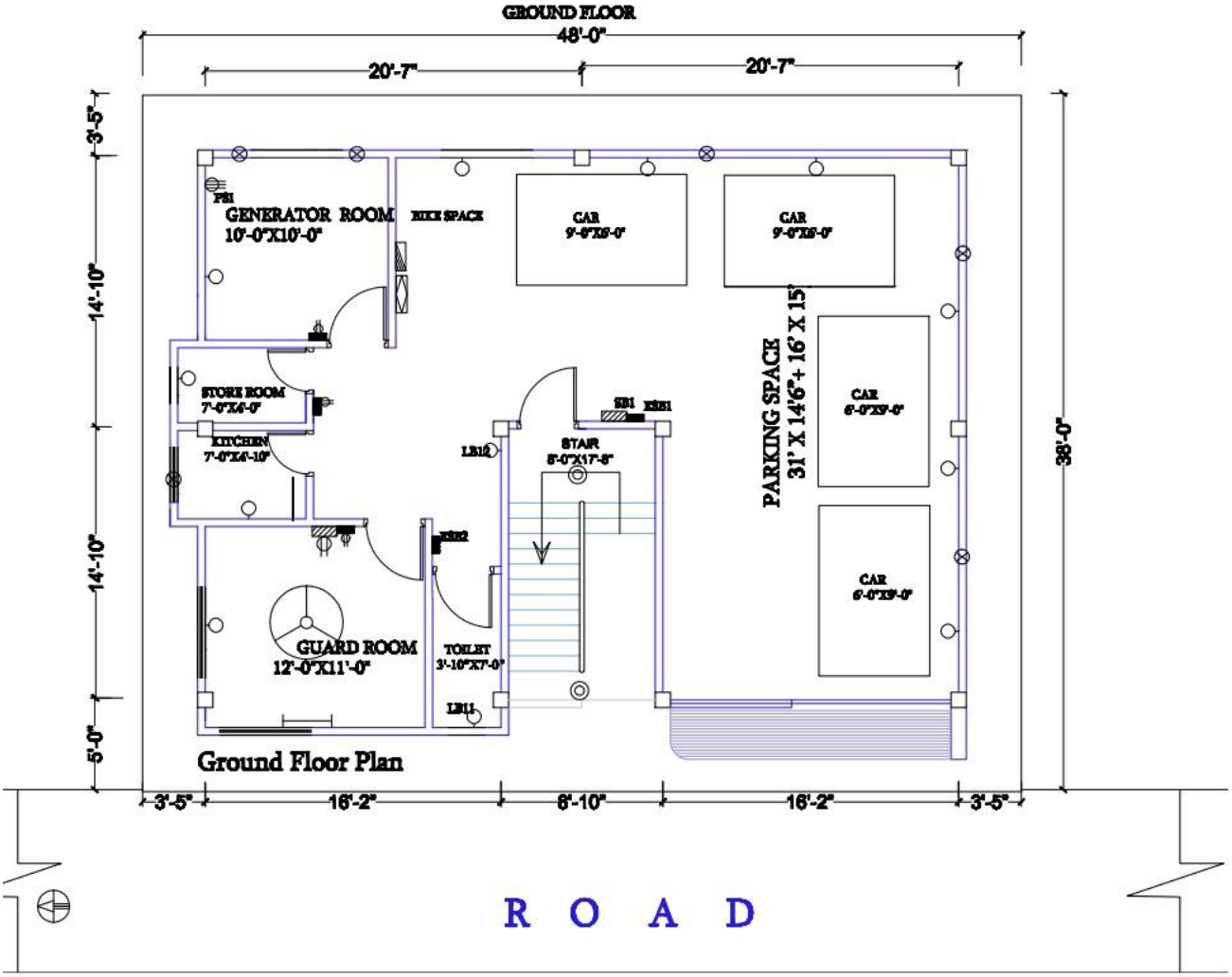
Date of Submission: 18/02/2022

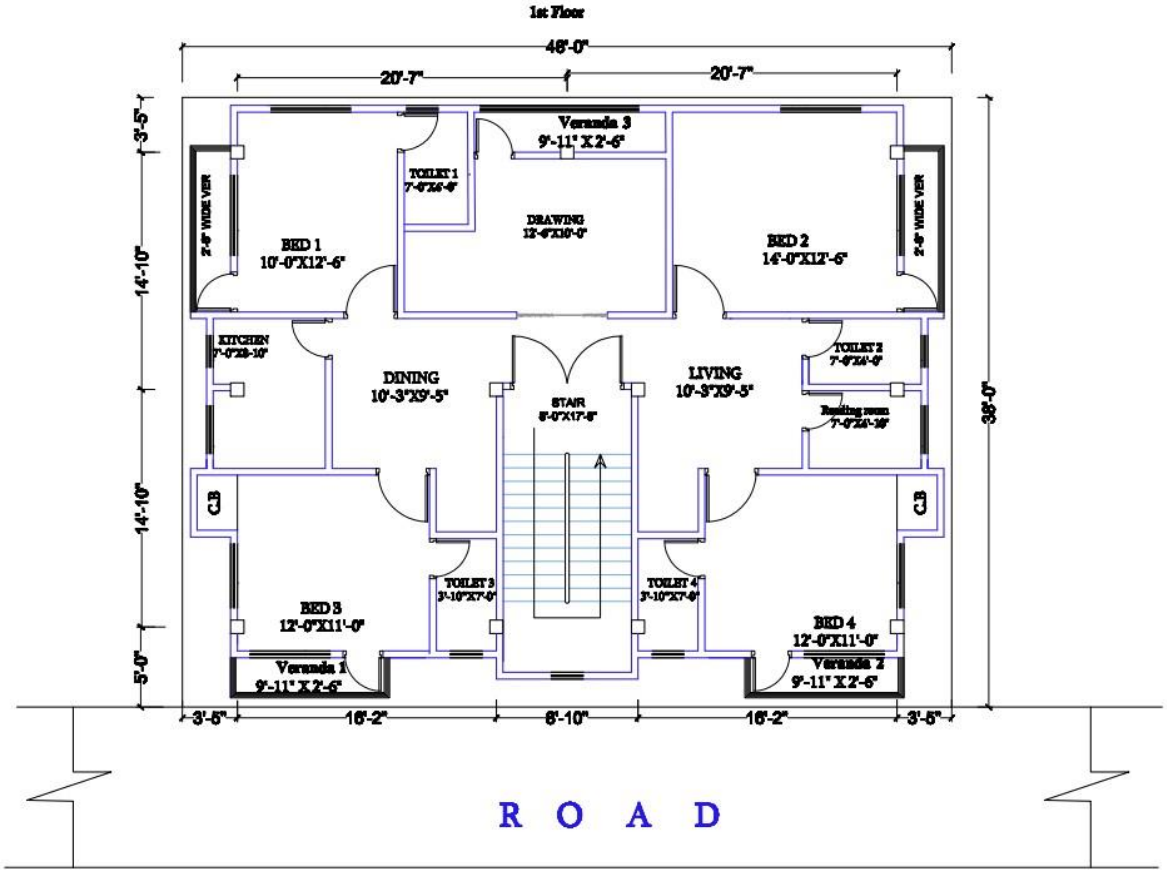
Fitting Fixture Layout

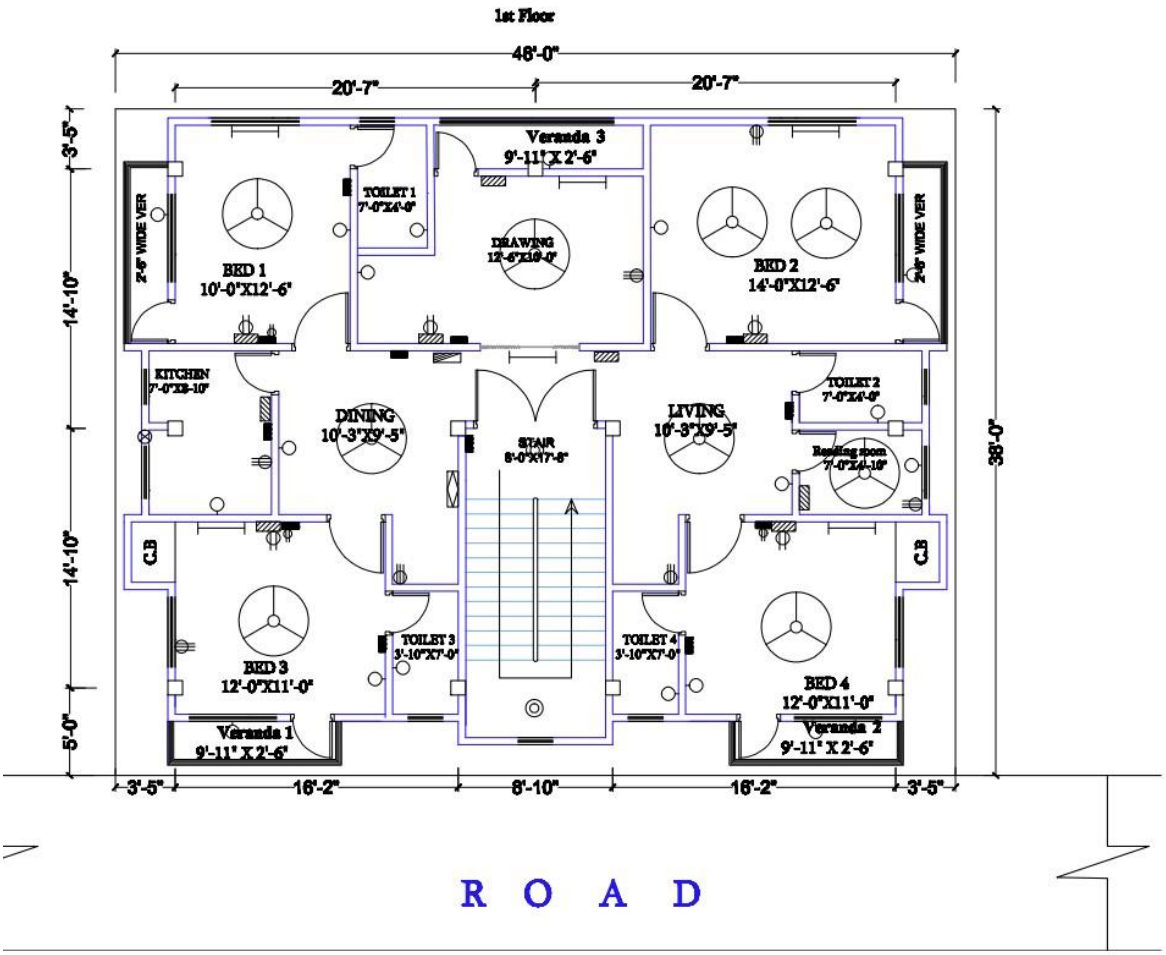
Ground Floor:




GROUND FLOOR
48'-0"
20'-7"
20'-7"
3'-5"
14'-10"
14'-10"
5'-0"
38'-0"
GENERATOR ROOM
10'-0"X10'-0"
BIKE SPACE
CAR
9'-0"X6'-0"
CAR
9'-0"X6'-0"
PARKING SPACE
31' X 14'6"+ 16' X 15'
CAR
6'-0"X9'-0"
CAR
6'-0"X9'-0"
STORE ROOM
7'-0"X6'-0"
KITCHEN
7'-0"X6'-10"
STAIR
5'-0"X17'-8"
GUARD ROOM
12'-0"X11'-0"
TOILET
3'-10"X7'-0"
Ground Floor Plan
3'-5"
16'-2"
6'-10"
16'-2"
3'-5"
R O A D

First Floor:


1st Floor
48'-0"
20'-7"
20'-7"
3'-5"
14'-10"
14'-10"
5'-0"
38'-0"
Veranda 3
9'-11" X 2'-6"
TOILET 1
7'-0"X6'-0"
DRAWING
12'-0"X10'-0"
BED 1
10'-0"X12'-6"
BED 2
14'-0"X12'-6"
2'-0" WIDE VER
2'-0" WIDE VER
KITCHEN
7'-0"X8'-10"
DINING
10'-3"X9'-5"
STAIR
8'-0"X17'-0"
LIVING
10'-3"X9'-5"
TOILET 2
7'-0"X6'-0"
Reading room
7'-0"X6'-10"
C.B
C.B
TOILET 3
3'-10"X7'-0"
TOILET 4
3'-10"X7'-0"
BED 3
12'-0"X11'-0"
BED 4
12'-0"X11'-0"
Veranda 1
9'-11" X 2'-6"
Veranda 2
9'-11" X 2'-6"
3'-5"
16'-2"
6'-10"
16'-2"
3'-5"
R O A D


1st Floor
46'-0"
20'-7"
20'-7"
3'-5"
14'-10"
14'-10"
5'-0"
38'-0"
Veranda 3
9'-11" X 2'-6"
TOILET 1
7'-0"X4'-0"
DRAWING
12'-6"X10'-0"
BED 1
10'-0"X12'-6"
2'-6" WIDE VER
BED 2
14'-0"X12'-6"
2'-6" WIDE VER
KITCHEN
7'-0"X8'-10"
DINING
10'-3"X9'-5"
STAIR
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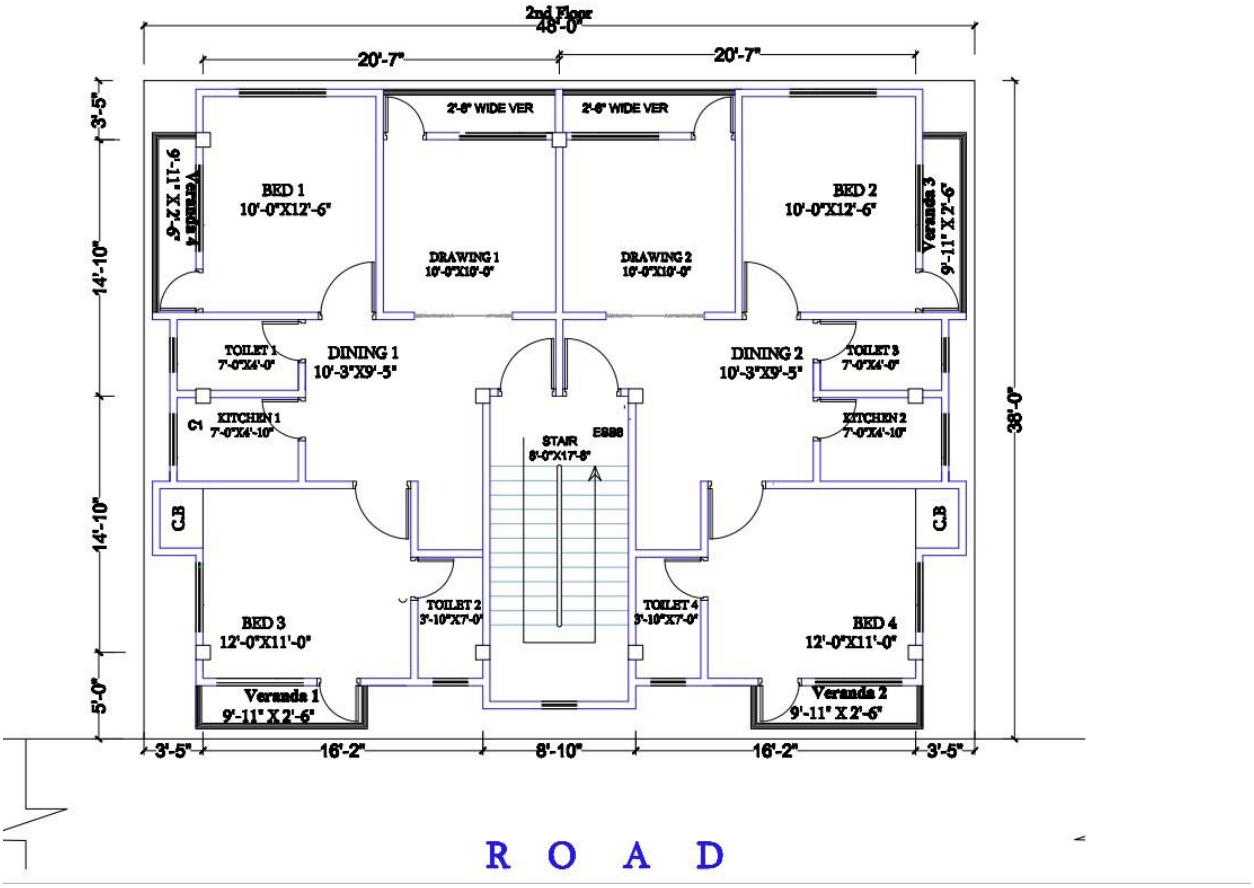
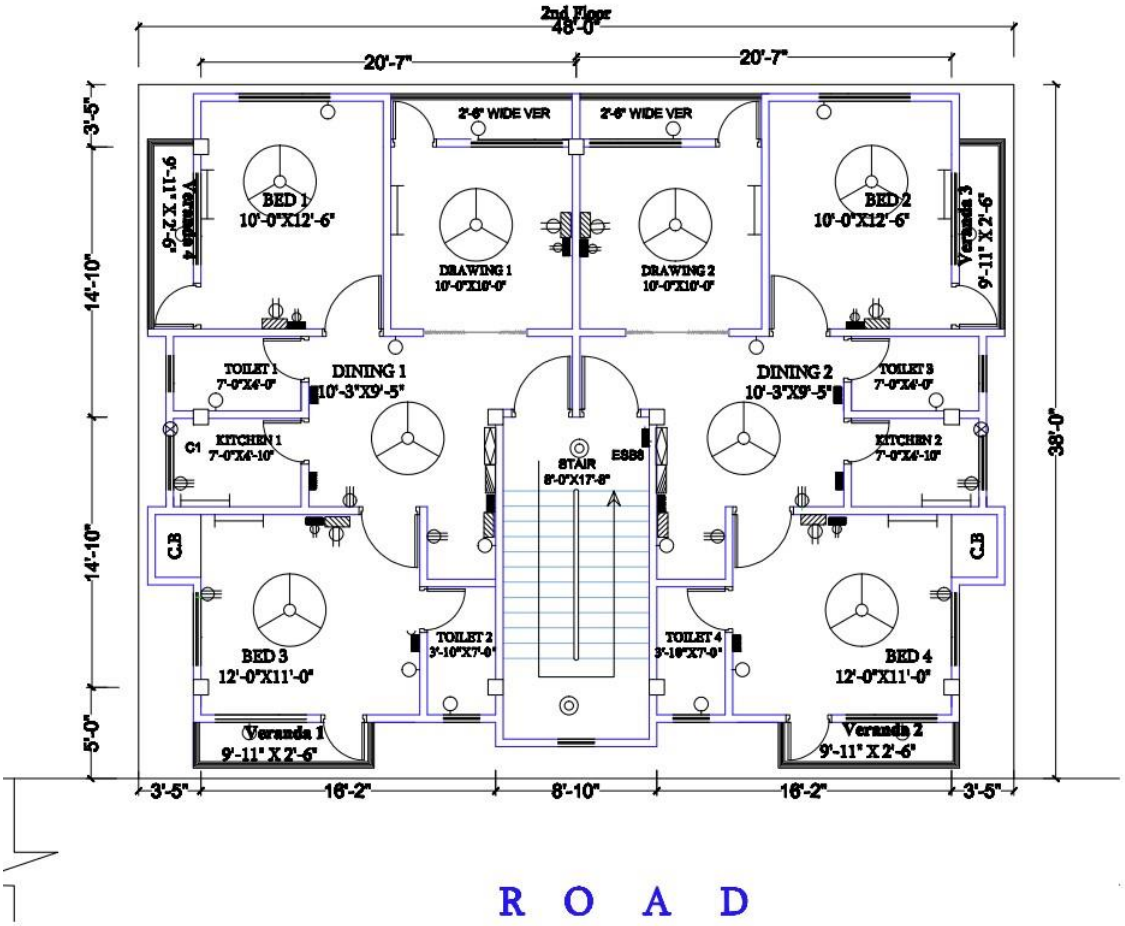
TOILET 2
7'-0"X4'-0"
Reading room
7'-0"X4'-10"
C.B
C.B
BED 3
12'-0"X11'-0"
TOILET 3
3'-10"X7'-0"
TOILET 4
3'-10"X7'-0"
BED 4
12'-0"X11'-0"
Veranda 1
9'-11" X 2'-6"
Veranda 2
9'-11" X 2'-6"
3'-5"
16'-2"
8'-10"
16'-2"
3'-5"
R O A D

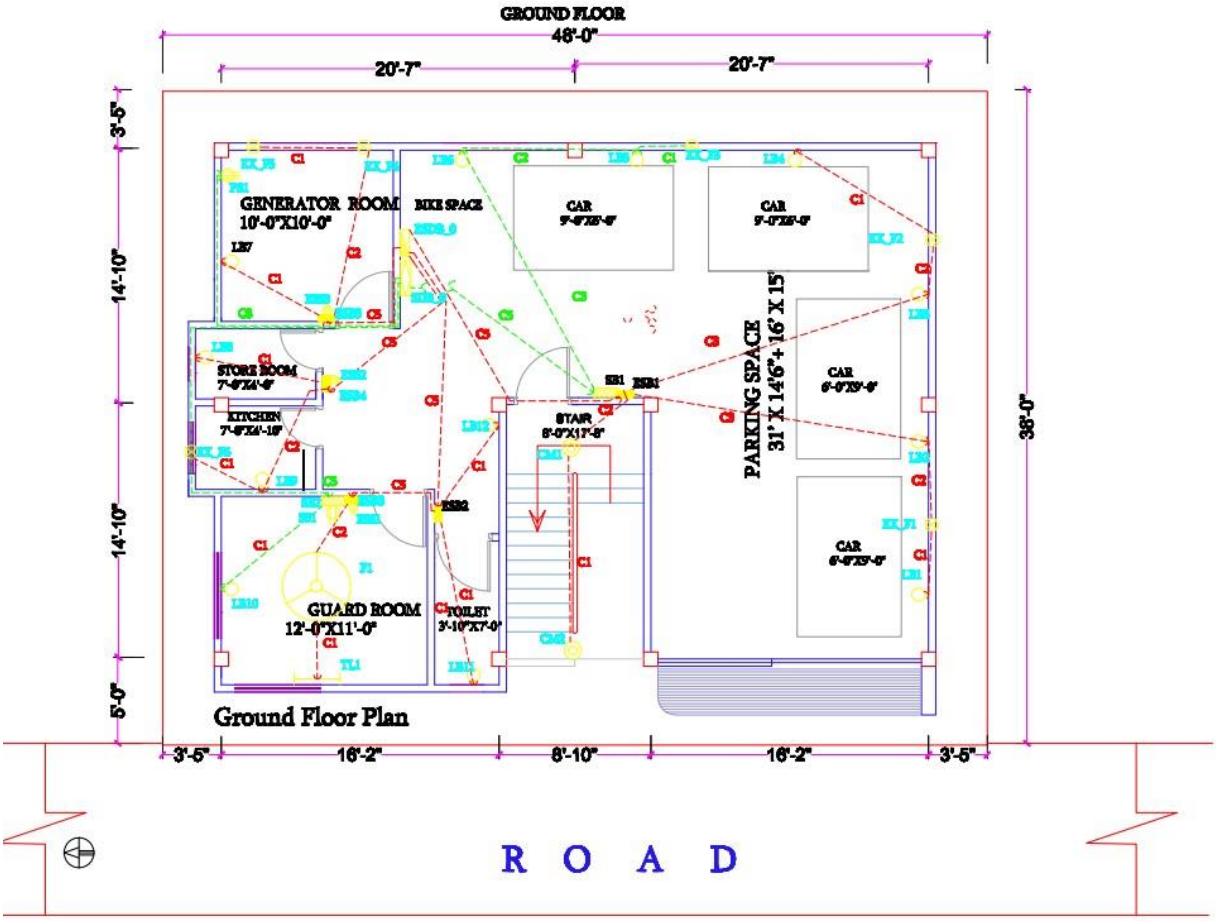
Second Floor:



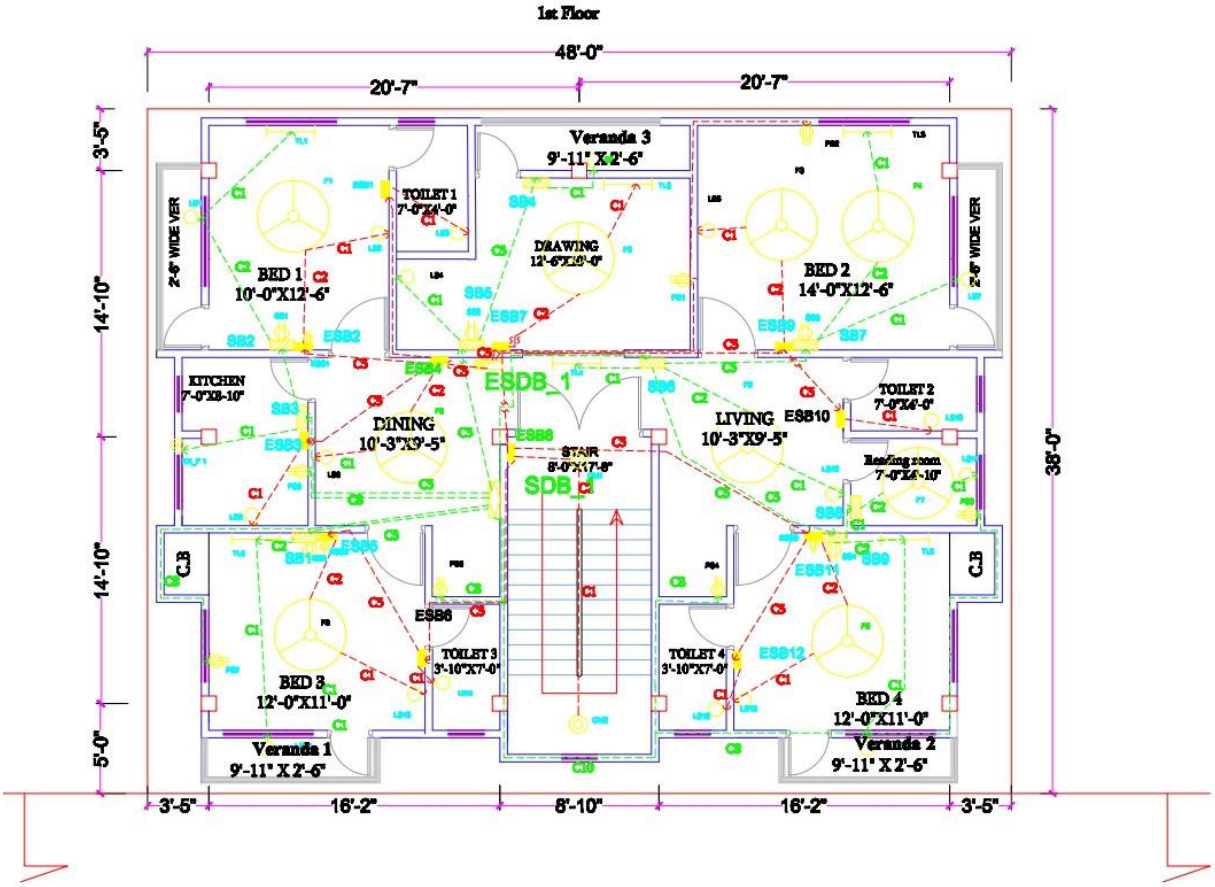

2nd Floor
48'-0"
20'-7"
20'-7"
3'-5"
14'-10"
14'-10"
5'-0"
38'-0"
2'-6" WIDE VER
2'-6" WIDE VER
BED 1
10'-0"X12'-6"
DRAWING 1
10'-0"X10'-0"
DRAWING 2
10'-0"X10'-0"
BED 2
10'-0"X12'-6"
Veranda 3
9'-11" X 2'-6"
Veranda 4
9'-11" X 2'-6"
TOILET 1
7'-0"X4'-0"
DINING 1
10'-3"X9'-5"
DINING 2
10'-3"X9'-5"
TOILET 3
7'-0"X4'-0"
C1
KITCHEN 1
7'-0"X4'-10"
STAIR
8'-0"X17'-8"
ESS
KITCHEN 2
7'-0"X4'-10"
C.B
C.B
BED 3
12'-0"X11'-0"
TOILET 2
3'-10"X7'-0"
TOILET 4
3'-10"X7'-0"
BED 4
12'-0"X11'-0"
Veranda 1
9'-11" X 2'-6"
Veranda 2
9'-11" X 2'-6"
3'-5"
16'-2"
8'-10"
16'-2"
3'-5"
R O A D

Condui Layout:

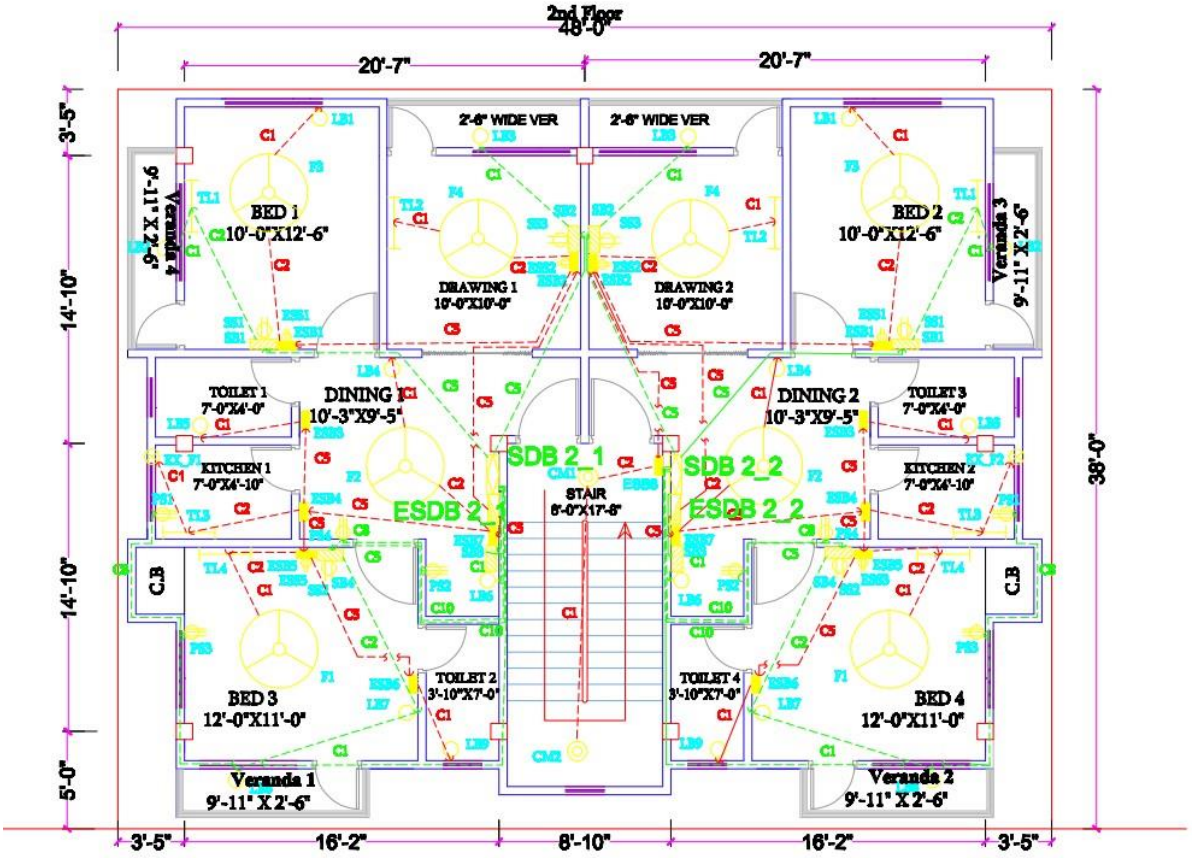
Ground Floor:



First Floor:

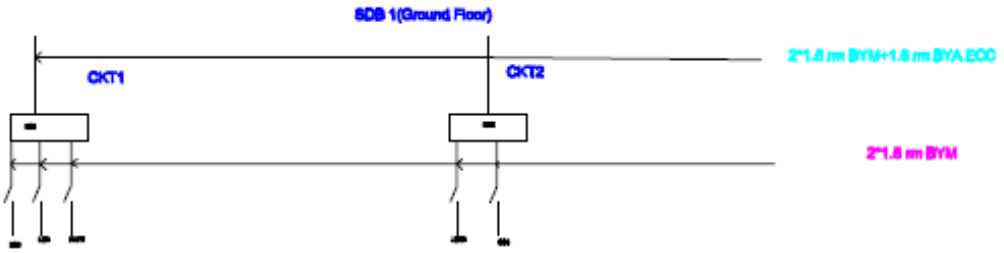

1st Floor
48'-0"
20'-7"
20'-7"
3'-5"
14'-10"
14'-10"
5'-0"
38'-0"
Veranda 3
9'-11" X 2'-6"
TOILET 1
7'-0"X4'-0"
DRAWING
12'-6"X10'-0"
BED 1
10'-0"X12'-6"
BED 2
14'-0"X12'-6"
2'-6" WIDE VER
2'-6" WIDE VER
KITCHEN
7'-0"X8-10"
DINING
10'-3"X9'-5"
ESDB_1
STAIR
8'-0"X17'-8"
SDB
LIVING
10'-3"X9'-5"
TOILET 2
7'-0"X4'-0"
Reading room
7'-0"X4'-10"
C.B
C.B
TOILET 3
3'-10"X7'-0"
TOILET 4
3'-10"X7'-0"
BED 3
12'-0"X11'-0"
BED 4
12'-0"X11'-0"
Veranda 1
9'-11" X 2'-6"
Veranda 2
9'-11" X 2'-6"
3'-5"
16'-2"
8'-10"
16'-2"
3'-5"

Second Floor:

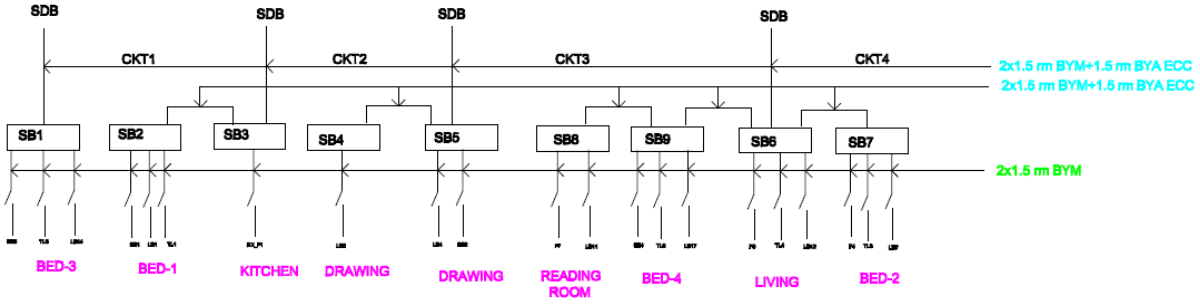


SWITCH BOARD DIAGRAM

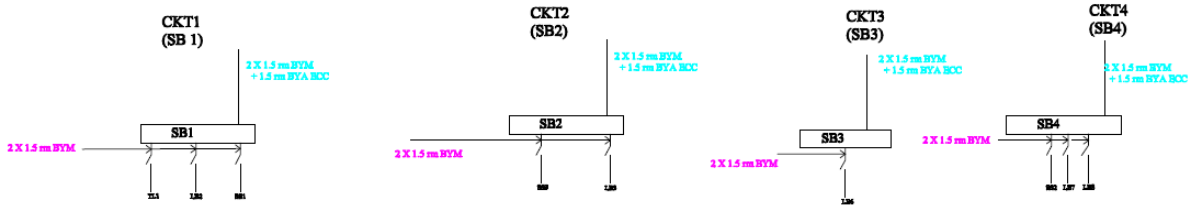
GROUND FLOOR



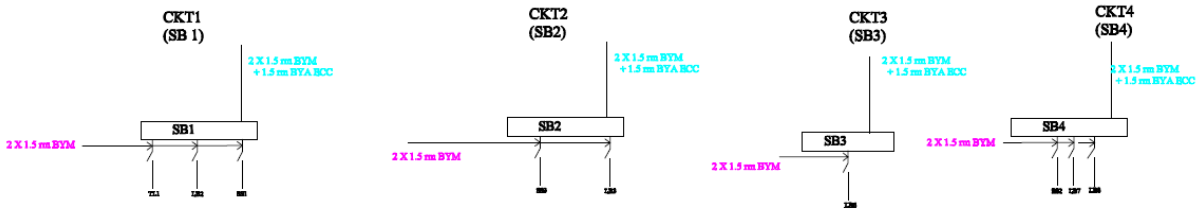
FIRST FLOOR



SECOND FLOOR UNIT 1

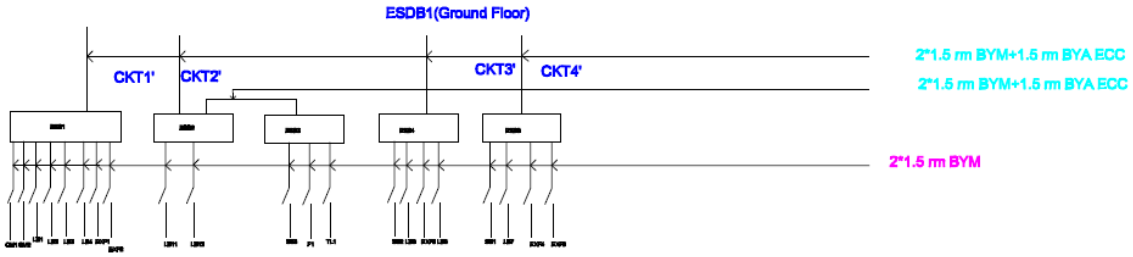


SECOND FLOOR UNIT 2

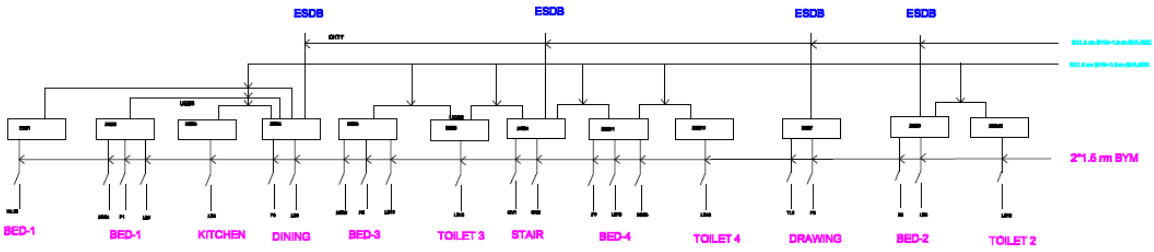


EMERGENCY SWITCH BOARD DIAGRAM

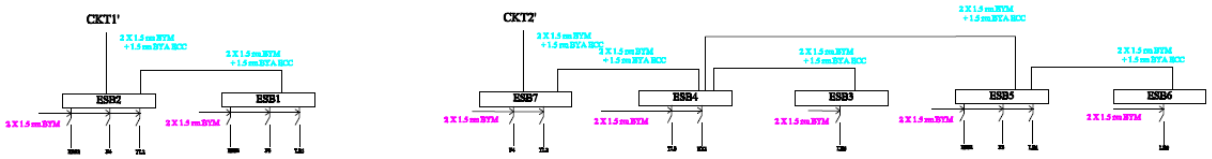
GROUND FLOOR



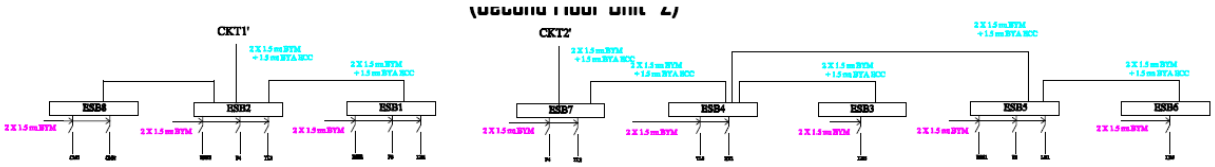
FIRST FLOOR



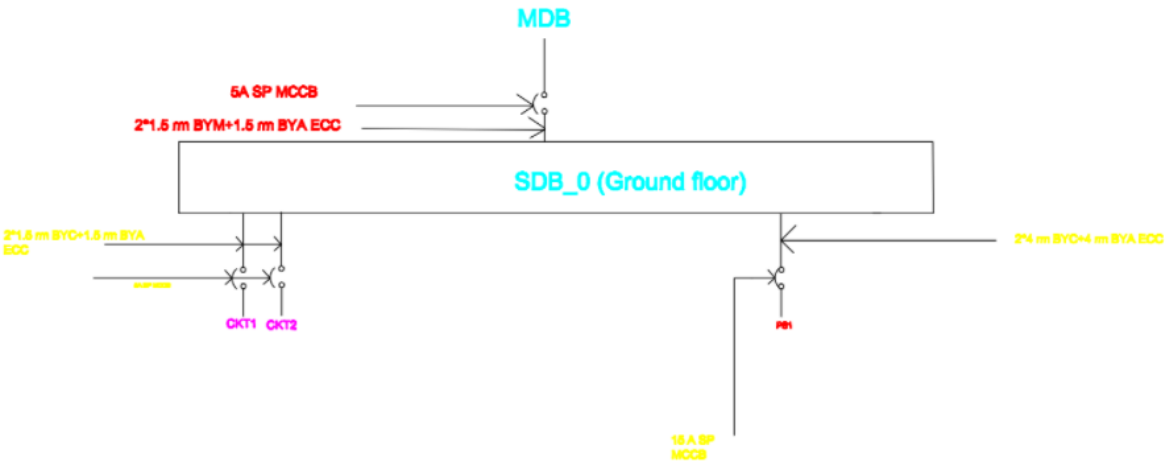
SECOND FLOOR UNIT 1

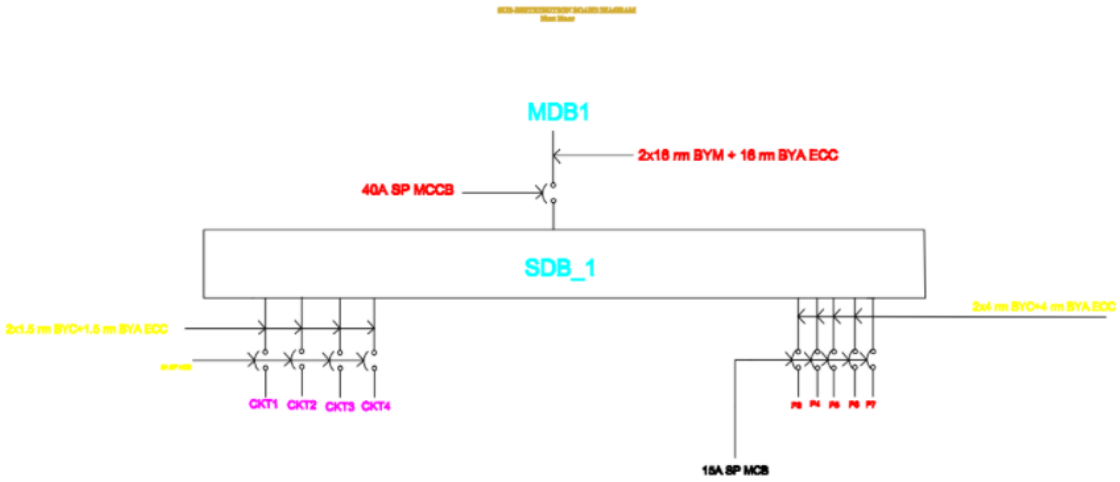


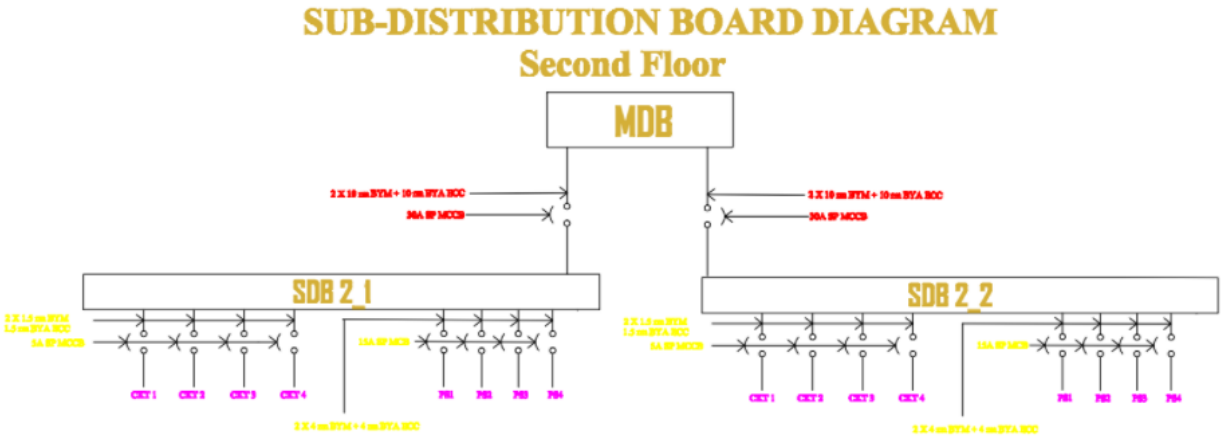
SECOND FLOOR UNIT 2



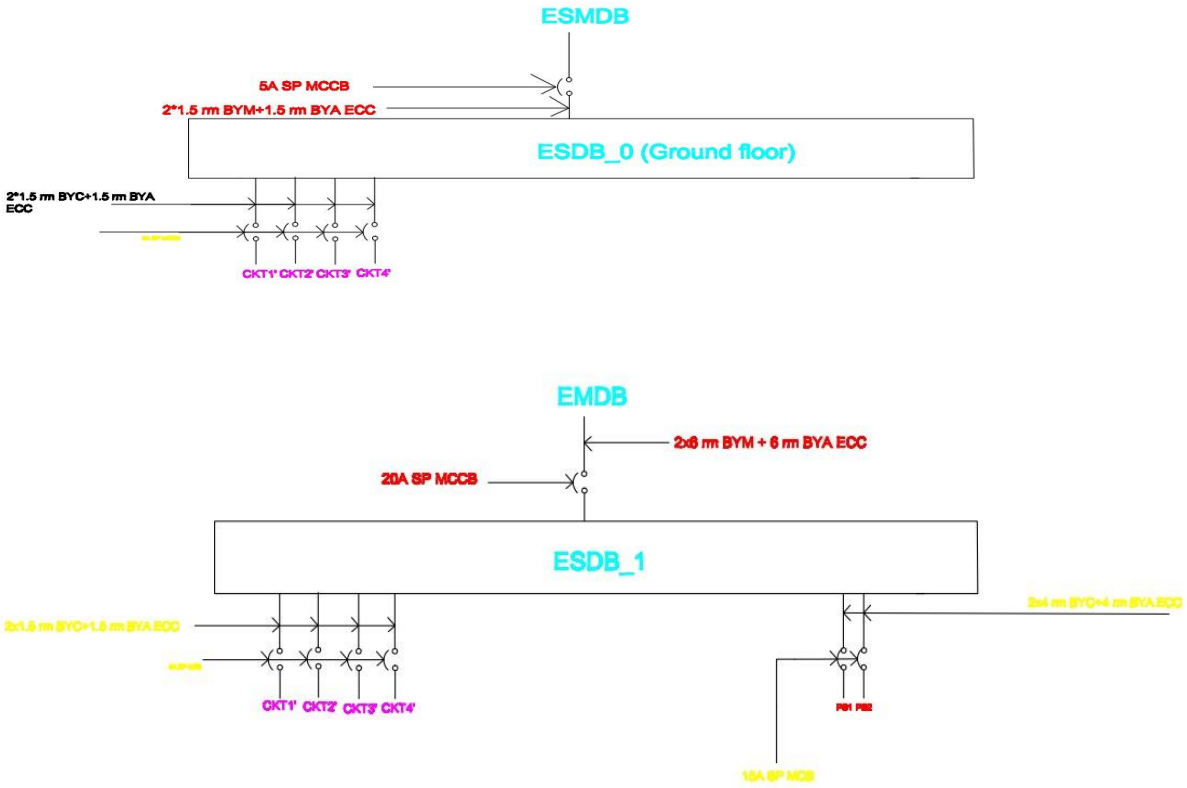
Distribution Board:



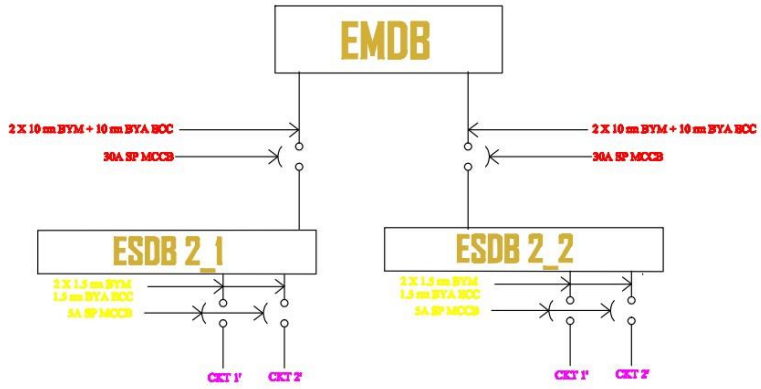

MDB1
2x16 mm BYM + 16 mm BYA ECC
40A SP MCCB
SDB_1
2x1.5 mm BYC+1.5 mm BYA ECC
2x4 mm BYC+4 mm BYA ECC
CKT1
CKT2
CKT3
CKT4
15A SP MCB


SUB-DISTRIBUTION BOARD DIAGRAM
Second Floor
MDB
SDB 2_1
SDB 2_2

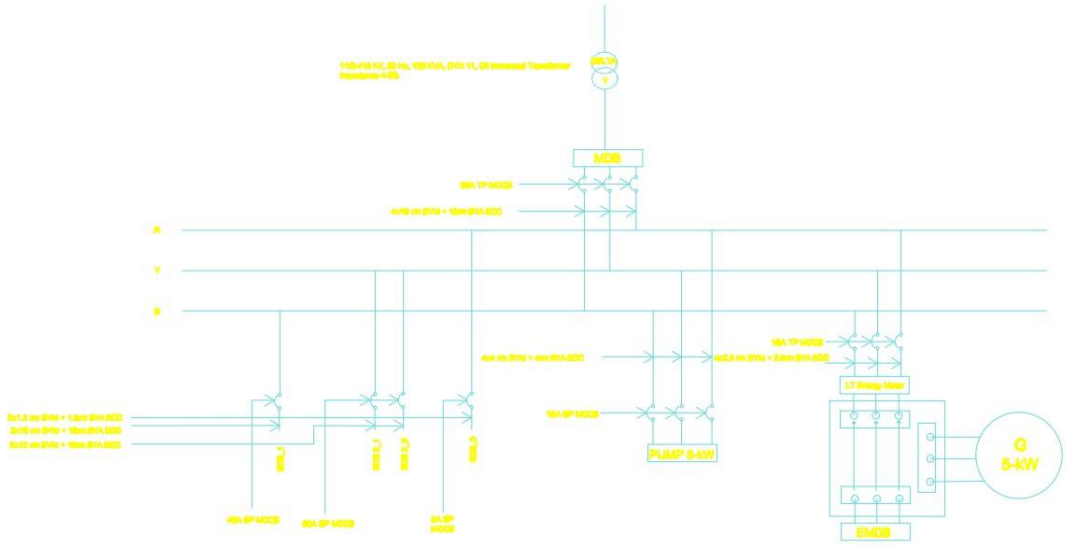
Emergency Distribution Board:



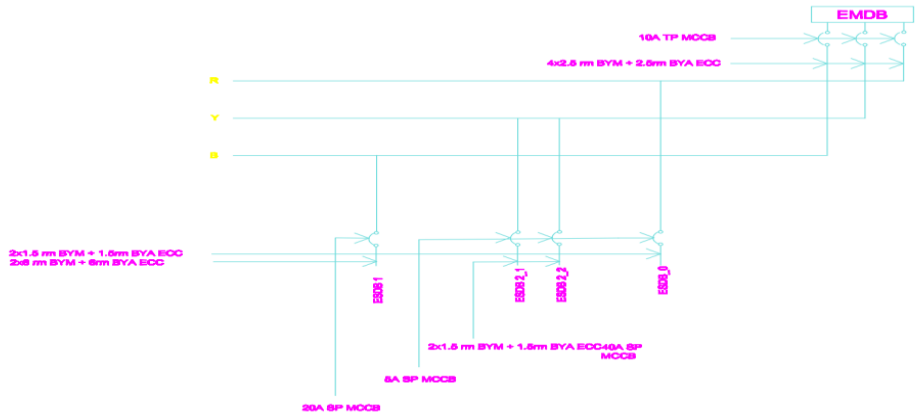
EMERGENCY
SUB-DISTRIBUTION BOARD DIAGRAM
Second Floor



Main Distribution Board Layout:



Main Emergency Distribution Board Layout:



Fitting Fixture Calculation

We know,

$$\boldsymbol{E = \frac{n * N * F * UF * LLF}{A}}, A\ in\ m^2$$

E = Illuminance

n = number of lights per illuminance

N = number of lights required

F = lumen of bulb

LLF = Light Loss Factor

UF = Utilization factor

A = area

$$\boldsymbol{F = \frac{A}{100}}, A\ in\ sq - ft$$

Here,

F = number of fans required

Calculation for Ground Floor:

Guard Room:

Area= 12’ * 10’=120 sqft = (120x 0.092903) m^2 =11.14836 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.27 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 1.2 ≈ 1

So, 1 Fan is required.

Space in front of guard room:

Area= 10' 6"*5'3" =55.125 sqft = (55.125 x 0.092903)m^2 =5.1213 m^2

Illuminance, E= 100Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.5853 ≈ 1

So, 1 Light Bulb is required.

Common Toilet:

Area= 3'10" x 7' =26.8sqft = (26.8 x 0.092903) m^2 =2.5 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.285 ≈ 1

So, 1 Light Bulb is required.

Store Room:

Area= 7' x 4' =28sqft = (28 x 0.092903) m^2 =2.604 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.3 ≈ 1

So, 1 Light Bulb is required.

Kitchen:

Area= 7'x 4'10" =33.83 sqft = (33.83 x 0.092903) m^2 =3.15 m^2

Illuminance, E= 200 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.72 ≈ 1

So, 1 Light bulb is required.

Number of Fans= 0.33 ≈ 1

1 Exhaust Fan is required.

Generator Room:

Area= 10' x 10' =100 sqft = (100 x 0.092903) m^2 =9.2903 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.062 ≈ 1

So, 1 light Bulb is required.

2 Exhaust Fans are provided.

Garage:

Area= 31’ x 14’6”+ 16’ x 15’ sqft = (689.5x 0.092903) m^2 = 64.05662 m^2

Illuminance, E = 70 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N = 5.1245

So, 5 Ceiling-mounted bulbs are required and 3 Exhaust Fans are required.

Staircases:

Area= 8’ x 17’8” = 141.33 sqft = (141.33 x 0.092903) m^2 = 13.13 m^2

Illuminance, E = 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb)

Number of Lights, N = 1.5 ≈ 2

So, 2 Ceiling-mounted light bulbs are required.

Calculation for First Floor:

Bedroom-1:

Area = 10’ x 12’6” = 125 sqft = (126 x 0.092903) m^2 = 11.613 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.33 ≈ 2

So, 1 light bulb and 1 tube light are required.

Number of Fans= 1.26 ≈ 1

So, 1 Fan is required.

Bedroom-3 and 4:

Area= 12’ x 11” = 132 sqft = (132 x 0.092903) m^2 = 12.263 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.4 ≈ 2

So, 1 light bulb and 1 tube light are required.

Number of Fans= 1.32 ≈ 1

So, 1 Fan is required.

Bedroom-2:

Area= 14’ x 12’6” = 175 sqft = (175 x 0.092903) m^2 = 16.26 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.86 ≈ 2

So, 1 Light bulb and 1 tube light are required.

Number of Fans= 1.75 ≈ 2

So, 2 Fans are required.

Drawing room:

Area= 12'6" x 10" = 125 sqft = (126 x 0.092903) m^2 = 11.613 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.33 ≈ 2

So, 1 light bulb and 1 tube light are required.

Number of Fans= 1.26 ≈ 1

So, 1 Fan is required.

Veranda 1, 2 and 3:

Area= 9'11" x 2'6" = 24.79 sqft = (24.79 x 0.092903) m^2 = 2.23 m^2

Illuminance, E= 70 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (8W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.1784 ≈ 1

So, 1 Ceiling-mounted light bulb is required

Toilet 1 and 3:

Area= 7’ x 4’ =28 sqft = (28 x 0.092903) m^2 = 2.61 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.28 ≈ 1

So, 1 Light Bulb is required.

Dining room:

Area= 10’3” x 9’5” = 96.52 sqft = (96.52 x 0.092903) m^2 = 8.96 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.024 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 0.96 ≈ 1

So, 1 Fan is required.

Living room:

Area= 10’3” x 9’5” = 96.52 sqft = (96.52 x 0.092903) m^2 = 8.96 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.024 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 0.96 ≈ 1

So, 1 Fan is required.

Kitchen:

Area= 7’ x 8’10” = 61.83 sqft = (61.83 x 0.092903) m^2 = 5.745 m^2

Illuminance, E= 200 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.313 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 0.6183 ≈ 1

1 exhaust fan is provided.

Toilet 2 and 4:

Area= 3’10” x 7’ =26.83 sqft = (26.83 x 0.092903) m^2 = 2.493 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Flouroscent Tube Light)

Number of Lights, N= 0.285 ≈ 1

So, 1 Light Bulb is required.

Reading room:

Area= 7’ x 4’10” = 33.833 sqft = (33.833 x 0.092903) m^2 = 3.1432 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N = 0.359

So, 1 Light Bulb is required.

Number of Fans = 0.33833 ≈ 1

So, 1 Fan is required.

Corridor and Staircases:

Area= 8’ x 17’8” = 141.33 sqft = (141.33 x 0.092903) m^2 = 13.13 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb)

Number of Lights, N = 1.5 ≈ 2

So, 2 light bulbs are required.

Calculation for Second Floor:

Bedroom-1 and 2:

Area = 10’ x 12’6” = 125 sqft = (126 x 0.092903) m^2 = 11.613 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N = 1.33 ≈ 2

So, 1 light bulb and 1 tube light are required.

Number of Fans= 1.26 ≈ 1

So, 1 Fan is required.

Bedroom-3 and 4:

Area= 12’ x 11” = 132 sqft = (132 x 0.092903) m^2 = 12.263 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.4 ≈ 2

So, 1 light bulb and 1 tube light are required.

Number of Fans= 1.32 ≈ 1

So, 1 Fan is required.

Drawing room 1 and 2:

Area= 10’ x 10’ = 100 sqft = (100 x 0.092903) m^2 = 9.29 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.06 ≈ 1

So, 1 light bulb is required.

Number of Fans= 1

So, 1 Fan is required.

Veranda 1, 2 and 3:

Area= 9'11" x 2'6" = 24.79 sqft = (24.79 x 0.092903) m^2 = 2.23 m^2

Illuminance, E= 70 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (8W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.1784 ≈ 1

So, 1 Ceiling-mounted light bulb is required

Toilet 1 and 3:

Area= 7' x 4' =28 sqft = (28 x 0.092903) m^2 =2.61 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 0.298

So, 1 Light Bulb is required.

Dining room 1 and 2:

Area= 10’3” x 9’5” = 96.52 sqft = (96.52 x 0.092903) m^2 = 8.96 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.024 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 0.96 ≈ 1

So, 1 Fan is required.

Kitchen 1 and 2:

Area= 7’ x 8’10” = 61.83 sqft = (61.83 x 0.092903) m^2 = 5.745 m^2

Illuminance, E= 200 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Fluorescent Tube Light)

Number of Lights, N= 1.313 ≈ 1

So, 1 Light Bulb is required.

Number of Fans= 0.6183 ≈ 1

1 exhaust fan is provided.

Toilet 2 and 4:

Area= 3’10” x 7’ =26.83 sqft = (26.83 x 0.092903) m^2 = 2.493 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb and Flouroscent Tube Light)

Number of Lights, N= 0.285 ≈ 1

So, 1 Light Bulb is required.

Corridor and Staircases:

Area= 8’ x 17’8” = 141.33 sqft = (141.33 x 0.092903) m^2 = 13.13 m^2

Illuminance, E= 100 Lumen/m^2

Light Loss Factor and Utilization Factor, LLF x UF = 0.7

Number of lights per illuminaire, n=1

Flux= 1250 Lumen (20W Energy Saving Bulb)

Number of Lights, N = 1.5 ≈ 2

So, 2 light bulbs are required.

Calculation for Conduit:

Legends:

C1= 2 x 1.5rm BYM

C2= 4 x 1.5rm BYM

C3= 6 x 1.5rm BYM

C4= 8 x 1.5rm BYM

C5= 2 x 1.5rm BYM + 1.5 rm BYA ECC

C6= 2 x 2.5rm BYM + 2.5 rm BYA ECC

C7= 4 x 2.5rm BYM + 2.5 rm BYA ECC

C8= 2 x 4rm BYM + 4 rm BYA ECC

C10= 4 x 4rm BYM + 2 x 4 rm BYA ECC

C12= 2 x 10rm BYM + 10 rm BYA ECC

C13= 2 x 16rm BYM + 16 rm BYA ECC

5A → 1.5rm (6 Cable for ¾" , 10 Cable for 1")

10A → 2.5rm (4 Cable for ¾" , 7 Cable for 1")

15A → 4rm(3 Cable for ¾" , 5 Cable for 1")

20A → 6rm (2 Cable for ¾" , 4 Cable for 1")

Formula for ampere rating, $I = PV * pf\ (A) PV * pf\ (A)$

pf= 0.7

Energy saving bulb = 20W

Tubelight =20W

Ceiling Light = 20W

Ceiling Fan = 100W

Switchboard Socket= 100W

Exhaust Fan = 60W

All internal wires are below 5A rating, so 2 x 1.5 rm BYM is used in all internal wiring.

Ground Floor:

To Sub Distribution Board (SDB1) of Ground Floor Unit:

CKT1 Rating (SB1)

$$I = \frac{20(LB6)+20(LB55)+60(EX\_F3)}{220*0.7} \text{ (A)}$$

=0.6493 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2 Rating (SB2)

$$I = \frac{20(LB10)+100(SS4)}{220*0.7} \text{ (A)}$$

=0.779 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

To Emergency Sub Distribution Board (ESDB1) of Ground Floor Unit:

CKT1' Rating (ESB1)

$$I = \frac{20(LB1)+20(LB2)+20(LB3)+20(LB4)+60(EX\_F1)+60(EX\_F2)+20(CM1)+20(CM2)}{220*0.7} \text{ (A)}$$

=1.5584 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2' Rating (ESB2 and ESB3)

$$I = \frac{20(LB11)+20(LB12)+100(SS3)+100(F1)+20(TL1)}{220*0.7} \text{ (A)}$$

=1.6883 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT3' Rating (ESB4)

$$I = \frac{100(SS2)+20(LB9)+60(EX\_F6)+20(LB8)}{220*0.7} \text{ (A)}$$

=1.2987 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT4' Rating (ESB5)

$$I = \frac{100(SS1)+20(LB7)+60(EX\_F4)+60(EX\_F5)}{220*0.7} \text{ (A)}$$

=1.5584 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

Calculations for SDB_0 (Ground Floor):

SDB1 LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1 LOAD + CKT2 LOAD +CKT3 LOAD+ CKT4 LOAD

P SOCKET LOAD = 3000W

CKT1 LOAD=100W

CKT2 LOAD=120W

TOTAL LOAD=220W

SDB LOAD = 220*0.7+ 1*3000*0.2 =754W

SDB CURRENT = $\frac{SDB\ LOAD}{V*pf}\ (A)$= $\frac{754}{220*0.7}\ (A)$=4.836 A

So, **2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.**

Calculations for ESDB_0 (Ground Floor):

ESDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1’ LOAD + CKT2’ LOAD +CKT3’ LOAD+ CKT4’ LOAD

P SOCKET LOAD = 3000W

CKT1’ LOAD=240W

CKT2’ LOAD=260W

CKT3’ LOAD=200W

CKT4’ LOAD=240W

TOTAL LOAD=940W

ESDB1 LOAD = 940*0.7=658W

ESDB1 CURRENT = $\frac{SDB\ LOAD}{V*pf}$ (A)= $\frac{658}{220*0.7}$ (A)=4.273 A

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

First Floor:

To Sub Distribution Board (SDB1) of First Floor Unit:

CKT1 Rating (SB1)

I = $\frac{20(LB14)+20(TL5)+100(SS5)}{220*0.7}$ (A)

=0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2 Rating (SB2,SB3)

I = $\frac{20(TL1)+20(LB1)+100(SS1)+60(EX\_F1)}{220*0.7}$ (A)

=1.30 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT3 Rating (SB4, SB5)

$$I = \frac{20(LB4)+20(LB5)+100(SS2)}{220*0.7} \text{ (A)}$$

=0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT4 Rating (SB6,SB7,SB8,SB9)

I=

$$\frac{100(F7)+20(LB11)+100(SS4)+20(TL6)+20(LB17)+100(F6)+20(TL4)+20(LB12)+100(F4)+20(TL3)+20(LB7)}{220*0.7}$$

(A) =3.50 A

So**, 2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

To Emergency Sub Distribution Board (ESDB1) of First Floor :

CKT1' Rating (ESB1,ESB2,ESB3,ESB4)

$$I = \frac{20(LB3)+20(LB2)+100(ESS1)+100(F1)+20(LB8)+100(F5)+20(LB9)}{220*0.7} \text{ (A)}$$

=2.46 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2' Rating (ESB5,SB6,ESB8,ESB11,ESB2)

I=

$$\frac{100(F8)+(LB13)20+(ESS2)100+20(LB15)+20(CM1)+20(CM2)+100(F9)+20(LB16)+100(ESS3)+20(LB15)}{220*0.7}$$

(A) =3.37 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT3' Rating (ESB7)

I = $\frac{20(TL2)+100(F2)}{220*0.7}$ (A) =0.77 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT4' Rating (ESB9,ESB10)

I = $\frac{20(LB6)+100(F3)+20(LB10)}{220*0.7}$ (A) =0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

Calculations for SDB_1 (1st Floor):

SDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1 LOAD + CKT2 LOAD +CKT3 LOAD+ CKT4 LOAD

P SOCKET LOAD = 3000W

CKT1 LOAD=140W

CKT2 LOAD=200W

CKT3 LOAD=140W

CKT4 LOAD=540W

TOTAL LOAD=1020W

SDB LOAD = 1020*0.7+ 5*3000*0.3 =5214 W

SDB CURRENT = $\frac{SDB\ LOAD}{V*pf}$ (A)= $\frac{5214}{220*0.7}$ (A)=33.86 A

So**, 2 x 16 rm BYM + 16 rm BYA ECC are used.**

Calculations for ESDB_1 (1st Floor):

SDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1' LOAD + CKT2' LOAD +CKT3' LOAD+ CKT4' LOAD

P SOCKET LOAD = 3000W

CKT1' LOAD=380W

CKT2' LOAD=520W

CKT3' LOAD=120W

CKT4' LOAD=140W

TOTAL LOAD=1160W

ESDB LOAD = 1160*0.7+3000*2*0.3=2612W

ESDB CURRENT = $\frac{SDB\ LOAD}{V*pf}$ (A)= $\frac{2612}{220*0.7}$ (A)=16.96 A

So, **2 x 6 rm BYM + 6 rm BYA ECC are used.**

Second Floor:

To Sub Distribution Board (SDB1) of Second Floor Unit:

CKT1 Rating (SB1)

I = $\frac{20(LB2)+20(TL1)+100(SS1)}{220*0.7}$ (A) =0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2 Rating (SB2)

I = $\frac{(LB3)20+(SS3)100}{220*0.7}$ (A) =0.779 A

So, 2 x 1.5 rm BYM + 1.5 BYA ECC are used.

CKT3 Rating (SB3)

I = $\frac{20(LB4)}{220*0.7}$ (A) =0.13A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT4 Rating (SB4)

$I = \frac{20(LB7)+20(LB8)+100(SS2)}{220*0.7}$ (A) =0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

To Sub Distribution Board (SDB2) of Second Floor unit:

CKT1 Rating (SB1)

$I = \frac{20(LB2)+20(TL1)+100(SS1)}{220*0.7}$ (A) =0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2 Rating (SB2)

$I = \frac{(LB3)20+(SS3)100}{220*0.7}$ (A) =0.779 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT3 Rating (SB3)

$I = \frac{20(LB4)}{220*0.7}$ (A) =0.13A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT4 Rating (SB4)

$I = \frac{20(LB7)+20(LB8)+100(SS2)}{220*0.7}$ (A) =0.909 A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

To Emergency Sub Distribution Board (ESDB1) of 2nd floor:

CKT1' Rating (ESB1,ESB2)

$I = \frac{100(F3)+20(LB1)+100(ESS1)+100(F4)+20(TL2)+100(ESS2)}{220*0.7}$ (A) =2.8571A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2' Rating (ESB3,ESB4,ESB5,ESB6,ESB7)

I=

$$\frac{20(LB5)+20(TL3)+60(EX1)+100(ESS1)+20(TL2)+100(F4)+20(LB9)+100(F3)+20(LB1)}{220*0.7}$$ (A) =2.987A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

To Emergency Sub Distribution Board (ESDB2) of Second Floor:

CKT1' Rating (ESB1,ESB2,ESB8)

I = $\frac{100(F3)+20(LB1)+100(ESS1)+100(F4)+20(TL2)+100(ESS2)+20(CM1)+20(CM2)}{220*0.7}$ (A) =3.1168A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

CKT2' Rating (ESB3,ESB4,ESB5,ESB6,ESB7)

I=

$$\frac{20(LB5)+20(TL3)+60(EX1)+100(ESS1)+20(TL2)+100(F4)+20(LB9)+100(F3)+20(LB1)}{220*0.7}$$ (A) =2.987A

So, **2 x 1.5 rm BYM + 1.5 BYA ECC are used.**

Calculations for SDB 2_1 (Second Floor):

SDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1 LOAD + CKT2 LOAD +CKT3 LOAD+ CKT4 LOAD

P SOCKET LOAD = 3000W

CKT1 LOAD=140W

CKT2 LOAD=120W

CKT3 LOAD= 20W

CKT4 LOAD=140W

TOTAL LOAD=420W

SDB LOAD = 420*0.7+ 4*3000*0.3 =3894W

SDB CURRENT = $\frac{SDB\ LOAD}{V*pf}\ (A)$= $\frac{3894}{220*0.7}\ (A)$=25.286 A

So, **2 x 10 rm BYM + 10 rm BYA ECC are used.**

Calculations for SDB 2 (2nd floor):

SDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1 LOAD + CKT2 LOAD +CKT3 LOAD+ CKT4 LOAD

P SOCKET LOAD = 3000W

CKT1 LOAD=140W

CKT2 LOAD=120W

CKT3 LOAD= 20W

CKT4 LOAD=140W

TOTAL LOAD=420W

SDB LOAD = 420*0.7+ 4*3000*0.3 =3894W

SDB CURRENT = $\frac{SDB\ LOAD}{V*pf}\ (A)$= $\frac{3894}{220*0.7}\ (A)$=25.286 A

So, **2 x 10 rm BYM + 10rm BYA ECC are used.**

Calculations for ESDB 2_1 (Second Floor):

ESDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1' LOAD + CKT2' LOAD

P SOCKET LOAD = 3000W

CKT1' LOAD=440W

CKT2' LOAD=460W

TOTAL LOAD=900W

ESDB LOAD = 900*0.7=630W

ESDB CURRENT = $\frac{SDB\ LOAD}{V*pf}$ (A)= $\frac{630}{220*0.7}$ (A)=4.0909 A

So, **2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.**

Calculations for ESDB 2_1 (Second Floor):

ESDB LOAD = TOTAL LOAD*0.7+ TOTAL P SOCKET LOAD*0.3

TOTAL LOAD=CKT1' LOAD + CKT2' LOAD

P SOCKET LOAD = 3000W

CKT1' LOAD=480W

CKT2' LOAD=460W

TOTAL LOAD=940W

ESDB LOAD = 940*0.7=658W

ESDB CURRENT = $\frac{SDB\ LOAD}{V*pf}$ (A)= $\frac{658}{220*0.7}$ (A)=4.2727 A

So, **2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.**

Calculations for EMDB:

EMDB Load = Total ESDB Load x 0.7

Total ESDB Load = ESDB_Gnd_unit + SDB_1ST Floor + ESDB_2nd Floor_U1 + ESDB_2nd Floor_U1

= 658 + 2612 + 630 + 658

= 4558 W

EMDB Current = $\frac{EMDB\ Load}{\sqrt{3} * Line\ Voltage * pf}$

Phase Voltage = 220 V

Line Voltage = $\sqrt{3}$ * 220 V = 381.05 V

Power Factor, pf = 0.7

EMDB Load = 4558 x 0.7 = 3190.6 W

$EMDB\ current = \frac{3190.6}{\sqrt{3} \times 381.05 \times 0.7} = 6.9\ A$

So, 10 A TP MCCB is needed from EMDB to MDB

A 5 KW Generator is used to supply the EMDB Load through an ATS.

Calculations for MDB

MDB load = Total SDB load x 0.7 + (EMDB load + Pump load) x 0.7

Total SDB load = SDB_Gnd_unit + SDB_1st Floor + SDB_2nd Floor_U1 + SDB_2nd Floor_U2

= 754+ 5214 + 3894 + 3894

= 13.756 KW

$$MDB\ current = \frac{MDB\ Load}{\sqrt{3} * Line\ Voltage * pf}$$

Phase Voltage = 220 V

Line Voltage = $\sqrt{3}$ x 220 V = 381.05 V

Power Factor, pf = 0.95 (Due to PFI plant)

Total SDB load = 13756 W

EMDB load = 3192 W

Pump load = 5000 W

MDB load = 13756 x 0.7 + (3192 + 5000) x 0.7 = 15362.6 W

$$MDB\ current = \frac{15362.6}{\sqrt{3} \times 381.05 \times 0.95} = 24.50\ A$$

So, 30 A TP MCCB is needed from MDB to Main Line

❖ Calculations for PFI Plant:

$cos\theta = 0.7, sin\theta = \sqrt{1 - (cos\theta)^2} = 0.714$

$Q = 3VIsin\theta = Ptan\theta = 15.67\ KVAR$

After pf improvement sinθ = 1

$$I = \frac{Q}{3 \times V \times sin\theta} = 23.74\ A$$

So, 30A TP MCCB is needed from PFI to MDB