JASHORE UNIVERSITY OF SCIENCE AND TECHNOLOGY

ELECTRICAL FITTINGS, FIXTURES AND CONDUIT LAYOUT DESIGN FOR ACADEMIC-1 BUILDING of JUST's 9th FLOOR

Course Name: Electrical Service Design & Drafting
Course Code: (EEE3112)

Submitted to

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ABSTRACT

The main objective of this project is to study, analyze and design electrical fittings and fixture layout and conduit layout for academic building 8th floor. For this purpose, we first designed the civil drawing layout for 9th floor. Then we analyzed all the electrical loads needed for that floor and we place them where it needed to be. Then we draw conduit layout for each room and lastly, we calculated all the wire gauges. Power from main distribution board to each switch board are also shown.

DESIGN FEATURES

For better understanding we divided our design into three main categories

PART A: electrical fittings and fixture design

PART B: conduit layout

PART C: load and wire calculation

The above design is created using AutoCAD 2022

GENERAL OVERVIEW OF ACADEMIC BUILDING 9th FLOOR

In this floor we have some office room in the east and most important there is a big exam hall on the west part of the floor for about 800 student capacities. There is also a lab which draws significant amount of power.

PART A

Electrical fittings and fixture design

After we created civil drawing of 9th floor on AutoCAD, we place electrical component needed for each room. Used electrical components and their symbol for fittings and fixture layout

COMPONENTS	SYMBOL
FAN 60W	
LIGHT FLUROSCENT 36W	
SOCKET TS5A	
WALL EXHAUST FAN 36W	
SWITCH BOX	
DISTRIBUTION BOX	
CIRCUIT BREAKER	

Figure 1 Component symbol

This is a room without any electrical component.

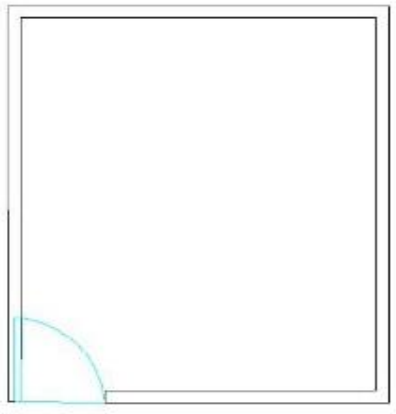

Figure 2 civil drawing of a room

Then we added required componet needed for this room

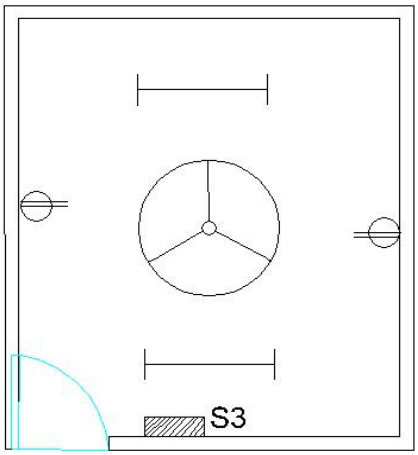

Figure 3 fittings and fixture layout

We did this process for all room in 9th floor and the design looks like this,

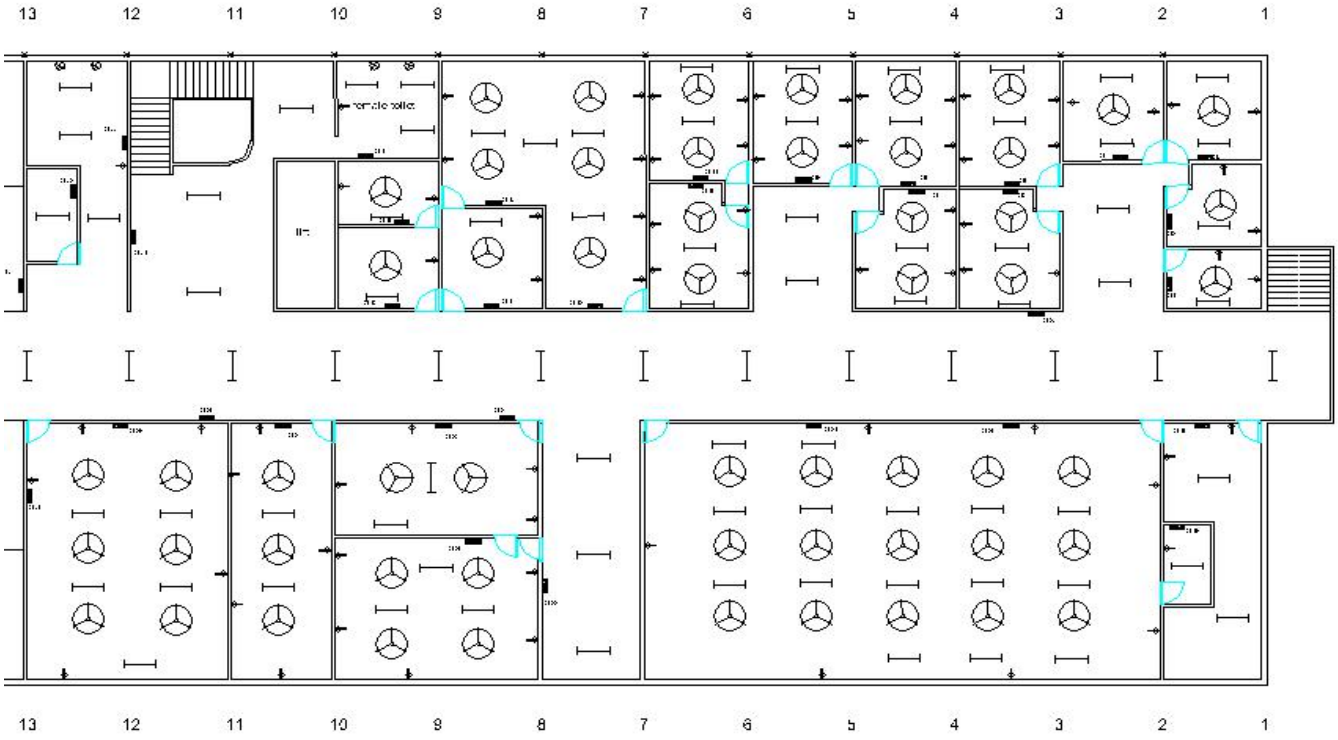

Figure 4 fittings and fixture layout for eastern part of academic building 8th floor

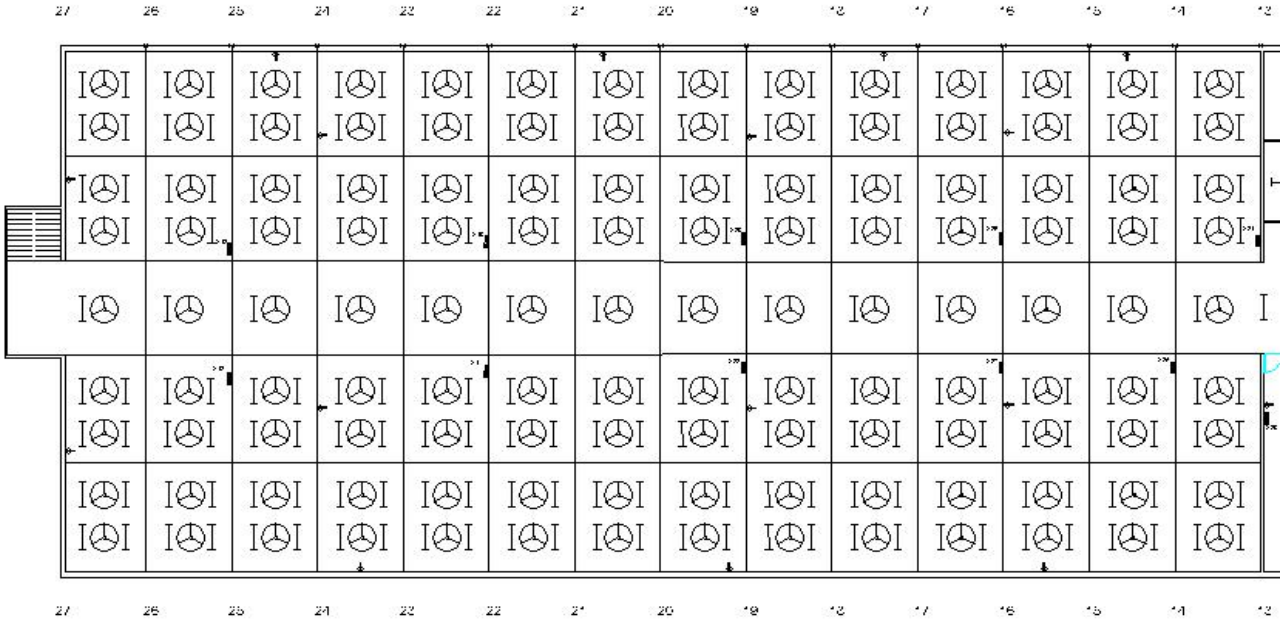

Figure 5 fittings and fixture layout for academic building 8th floor west

PART B

CONDUIT DESIGN

After adding fittings and fixtures layout, we added conduit layout for the room.We did this for every single room on 9th floor and the whole looks like this below,

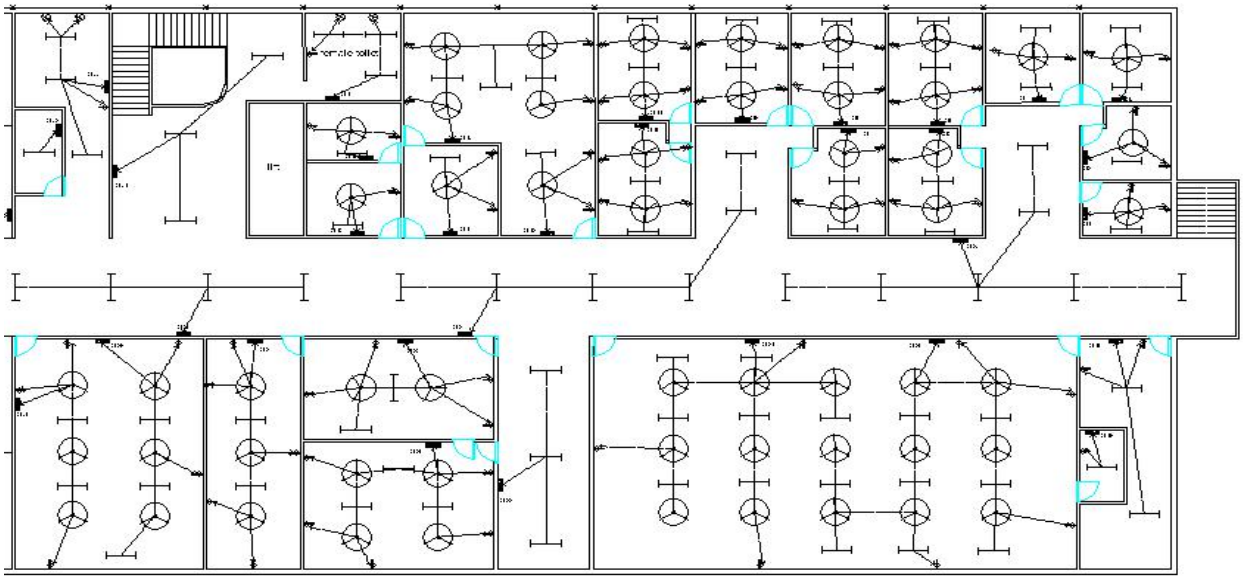

Figure 6 conduit layout for eastern part

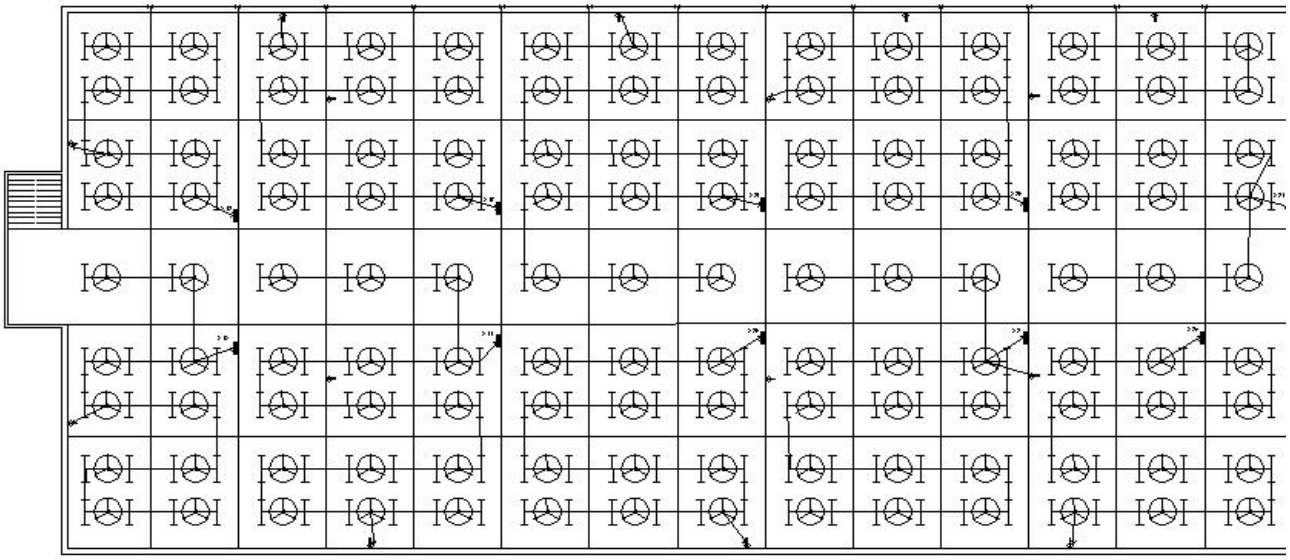

Figure 7 conduit layout for west part

PART C

LOAD CALCULATION AND SELECTION OF WIRE

Now we give a sample about how we calculate load and select wires. A simple room looks like this

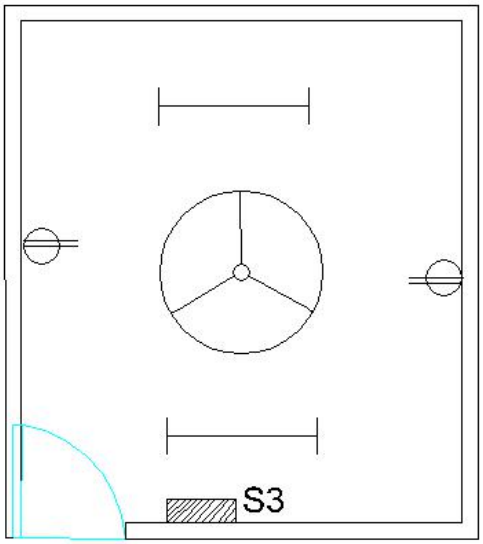

Figure 8 A room with switch board s3

It has two light a fan and two socket.the switch board diagram is

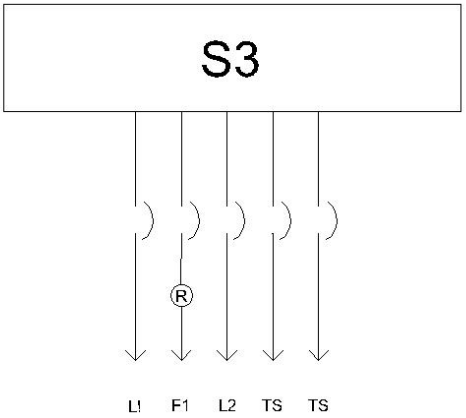

Figure 9 Switch boars diagram for above room

The used fans, lights, exhaust fans and sockets have the ratings of 60W, 36W, 36W and 5A respectively.

For this switch board S03:

Total load=(2×36+60+2x100)+25% Extra

=[332+(332x25)/100] watt

=415 watt

So, total power P=415 watt

Line voltage V=220V

Line current I= P/Vcosα

=[415/220x0.8] A

=2.40 A

Now , from American Wire Gauge Conductor Size Table

We get, Area of the conductor A=1.04 mm^2

Wire gauge(WG)=17

AWG	Diameter [inches]	Diameter [mm]	Area [mm^2]	Resistance [Ohms / 1000 ft]	Resistance [Ohms / km]	Max Current [Amperes]	Max Frequency for 100% skin depth
0000 (4/0)	0.46	11.684	107	0.049	0.16072	302	125 Hz
000 (3/0)	0.4096	10.40384	85	0.0618	0.202704	239	160 Hz
00 (2/0)	0.3648	9.26592	67.4	0.0779	0.255512	190	200 Hz
0 (1/0)	0.3249	8.25246	53.5	0.0983	0.322424	150	250 Hz
1	0.2893	7.34822	42.4	0.1239	0.406392	119	325 Hz
2	0.2576	6.54304	33.6	0.1563	0.512664	94	410 Hz
3	0.2294	5.82676	26.7	0.197	0.64616	75	500 Hz
4	0.2043	5.18922	21.2	0.2485	0.81508	60	650 Hz
5	0.1819	4.62026	16.8	0.3133	1.027624	47	810 Hz
6	0.162	4.1148	13.3	0.3951	1.295928	37	1100 Hz
7	0.1443	3.66522	10.5	0.4982	1.634096	30	1300 Hz
8	0.1285	3.2639	8.37	0.6282	2.060496	24	1650 Hz
9	0.1144	2.90576	6.63	0.7921	2.598088	19	2050 Hz
10	0.1019	2.58826	5.26	0.9989	3.276392	15	2600 Hz
11	0.0907	2.30378	4.17	1.26	4.1328	12	3200 Hz
12	0.0808	2.05232	3.31	1.588	5.20864	9.3	4150 Hz
13	0.072	1.8288	2.62	2.003	6.56984	7.4	5300 Hz
14	0.0641	1.62814	2.08	2.525	8.282	5.9	6700 Hz
15	0.0571	1.45034	1.65	3.184	10.44352	4.7	8250 Hz
16	0.0508	1.29032	1.31	4.016	13.17248	3.7	11 k Hz
17	0.0453	1.15062	1.04	5.064	16.60992	2.9	13 k Hz
18	0.0403	1.02362	0.823	6.385	20.9428	2.3	17 kHz
19	0.0359	0.91186	0.653	8.051	26.40728	1.8	21 kHz
20	0.032	0.8128	0.518	10.15	33.292	1.5	27 kHz
21	0.0285	0.7239	0.41	12.8	41.984	1.2	33 kHz
22	0.0254	0.64516	0.326	16.14	52.9392	0.92	42 kHz
23	0.0226	0.57404	0.258	20.36	66.7808	0.729	53 kHz
24	0.0201	0.51054	0.205	25.67	84.1976	0.577	68 kHz
25	0.0179	0.45466	0.162	32.37	106.1736	0.457	85 kHz
26	0.0159	0.40386	0.129	40.81	133.8568	0.361	107 kHz
27	0.0142	0.36068	0.102	51.47	168.8216	0.288	130 kHz

Figure 10 american wire gauge conductor size table

We have to calculate the total maximum current through the supply to distribution board connection wire and distribution board to each switch board. We used here 1mm^2 cross sectional area for any value of current less than 11A for the better safety.

We considered extra 30% power of the fans and lights power in out calculations. The formula used for the calculations for current for each switch board,

$$I = \frac{(n*60W+m*36W)*130\%}{V\cos\theta}+p*5A$$

Where, n, m, p are the number of fans, lights & exhaust fans and sockets respectively.

Table : Maximum current for switch boards and respective cross sectional area for single ore PVC isolated cables:

Switch Board Name	**Number of Fans**	**Number of Lights**	**Number of Sockets**	**Maximum Current (Ampere)**	**C.S.A. (mm^2)**

S1	1	1	2	10.7	1
S2	1	1	2	10.7	1
S3	1	2	2	10.8	1
S4	1	2	2	10.8	1
S5	2	2	3	16.4	2.5
S6	2	2	4	21.4	4
S7	2	2	3	16.4	2.5
S8	2	2	4	21.4	4
S9	2	2	4	21.4	4
S10	2	2	4	21.4	4
S11	2	2	4	21.4	4
S12	1	1	2	10.7	1
S13	4	3	4	22.6	4
S14	1	1	2	10.7	1
S15	1	1	1	5.6	1
S16	1	1	2	10.7	1
S17	2(Exhaust)	3	1	6.3	1
S18	0	1	2	10.2	1
S19	0	1	1	5.2	1
S20	8	8	4	25.6	4
S21	7	7	3	20	2.5
S22	0	3	0	0.8	1
S23	0	7	0	1.9	1
S24	0	6	0	1.6	1
S25	2	2	4	21.4	4
S26	4	3	5	27.6	6
S27	3	2	4	21.9	4
S28	0	4	0	1.1	1
S29	3	3	2	12.1	1.5
S30	3	2	3	16.9	2.5
S31	0	3	0	0.8	1
S32	0	1	0	0.3	1
S33	2(Exhaust)	3	1	6.3	1
S34	15	27	2	23.8	4
S35	12	24	1	16.7	2.5
S36	12	24	2	21.7	4
S37	15	27	2	23.8	4
S38	12	24	1	16.7	2.5
S39	15	19	1	16.7	2.5

S40	12	16	2	19.5	2.5
S41	12	24	2	21.7	4
S42	10	18	1	14.2	1.5
S43	8	16	1	12.8	1.5
Total	179 +Exhaust-4	305	90	277(Assumed 25% sockets at full load)	190

Switch board connection from main distribution board

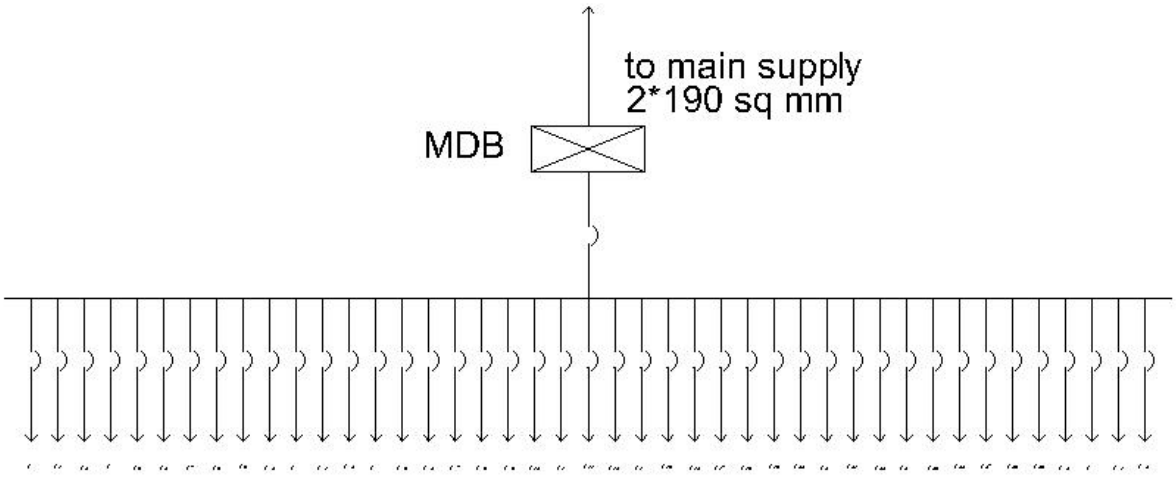

Figure 11 switch board connection with main distribution board