Khulna University of Engineering & Technology (KUET) Khulna- 9203.

Project on Electrical and Electronic Shop Practice (EE 2200)

Project Title: Wiring Design of 'Reading Room of Central Library '.

SUBMITTED TO:

Dr. Md. Abdur Rafiq

Professor,

Department of Electrical and Electronic

Engineering, KUET.

Dr. Md. Arafat Hossain

Assistant Professor,

Department of Electrical and Electronic

Engineering, KUET.

SUBMITTED BY:

Serial No.	Name	Roll
1	Md. Ataur Rahman	1703002
2	Tabshir Bin Bashar	1703017
3	Mainul Islam	1703032
4	Md. Maheeul Kabeer	1703047

INTRODUCTION:

Electrical wiring is one of the most and foremost concern in designing a structure. After receiving the blue prints from the architect, estimation needs to be done. Estimating is something that defines determining the quantity for electrical accessories and their costs.

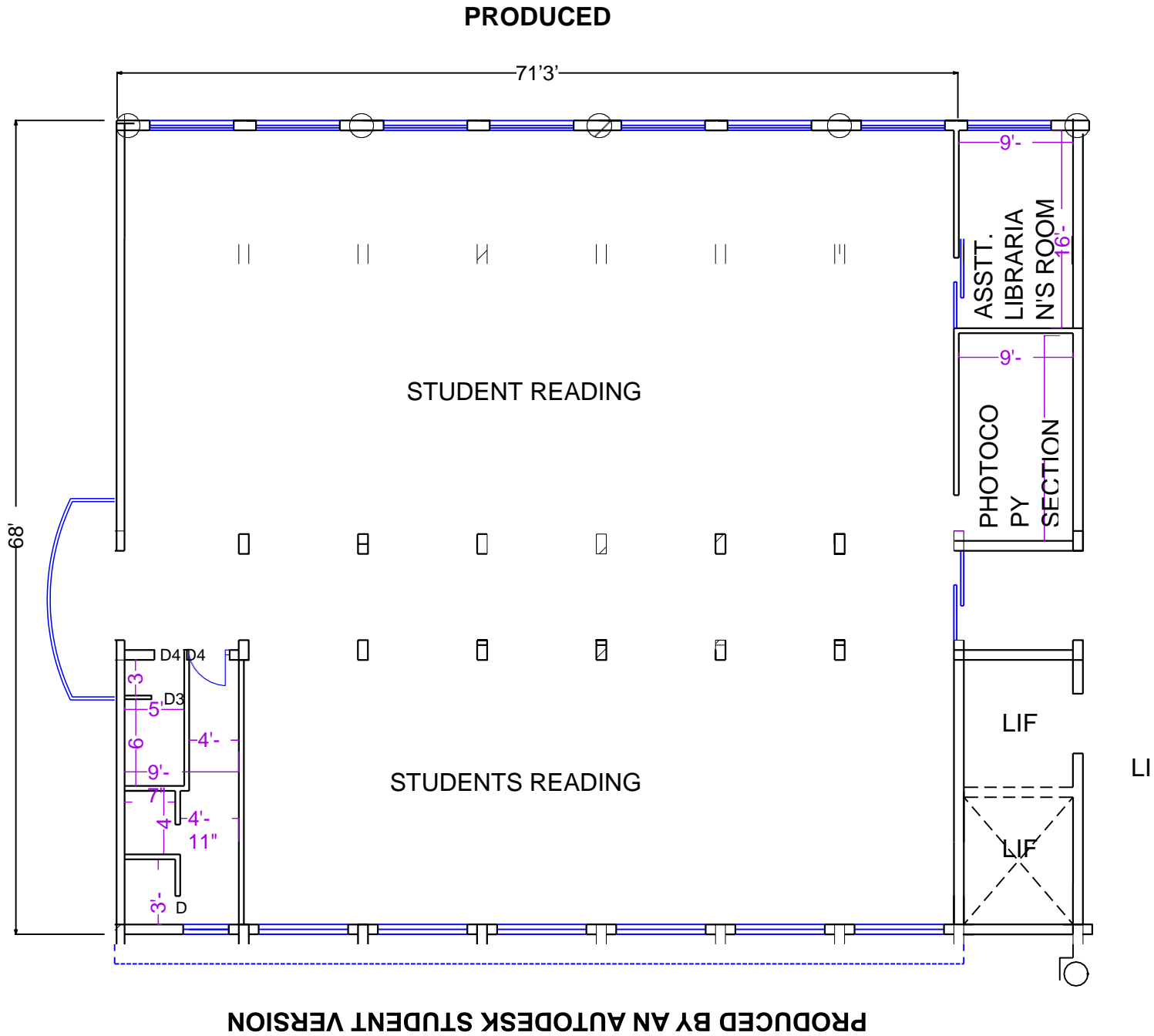The main steps that are involved in designing and calculate the costing are as follows:

1. Collect the layout of the building
2. Make a AUTOCAD model of the building
3. Measure the area of different portion
4. Calculate the required illumination
5. Calculate the wattage and amperage and distribute the load
6. Design the conduit model
7. Calculate the total wire needed
8. Cost calculation

About This Project

This project is based on the wiring design of the reading room of KUET central library. It is placed at the 2nd floor of block A of New Academic Building.
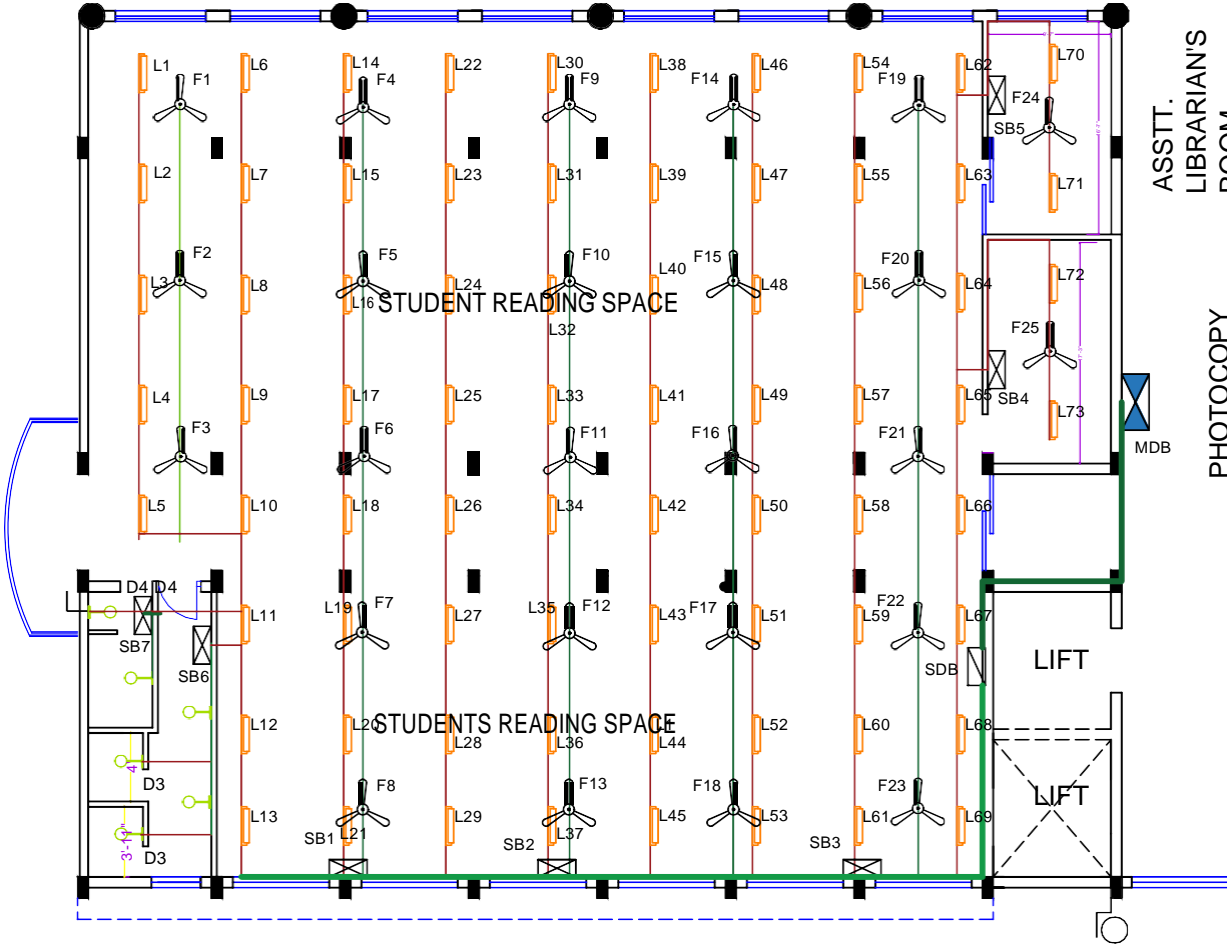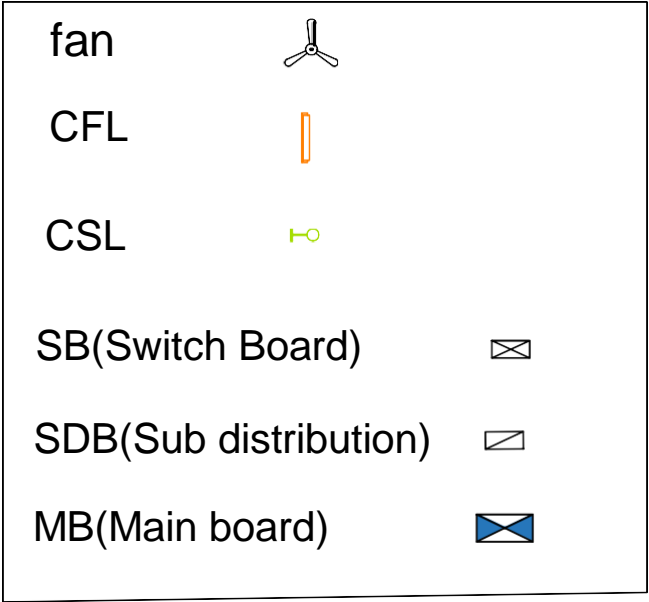
The architectural view is shown first to see the whole plan and to make it easy for an electrical engineer to have a total view of it. Then the electrical wiring design have been shown. It has been tried to make the design easily understandable to anyone who sees it. The library reading room also has a photocopy section and assistant librarian's room. Besides, there is also a washroom attached to it with separate toilets for male and female students. Designs have been made for those rooms too. The illumination has been calculated to obtain the usable light and its placing. The full load current has then been calculated from the load calculation. The conduit size as well as

wire size and length has been calculated. Hence considering all other equipment cost and labor cost the optimum cost is calculated for the reading room.

71'3'

69'

9'-

16'-

ASSTT. LIBRARIA N'S ROOM

9'-

PHOTOCO PY SECTION

STUDENT READING

D4 D4

D3

3

5

6

9'-

7'

4

4'-

4'-
11"

3'-

D

STUDENTS READING

LIF

LIF

LI

Electrical design of Central Library Reading Room

Legend:

fan	
CFL	
CSL	
SB(Switch Board)	
SDB(Sub distribution)	
MB(Main board)	

STUDENT READING SPACE

STUDENTS READING SPACE

ASSTT. LIBRARIAN'S ROOM

PHOTOCOPY SECTION

LIFT

LIFT

MDB

SDB

SB1 SB2 SB3 SB4 SB5 SB6 SB7

Spacing between two lights along 71' 3'' = 7.92 ft

Spacing between two lights along 68'5.5'' = 5.56 ft

Distance between two fans along 71' 3'' = 14.25 ft

Distance between two fans along 68'5.5'' = 13.7 ft

Illumination calculation

Calculation of Illumination:

Formula:

$$\text{Required illumination} = \frac{\text{Area} \times \text{Standard illumination}}{\text{Depreciation factor} \times \text{Utilization factor}}$$

Depreciation factor varies from 0.6 to 0.8.

Utilization factor varies from 0.4 to 0.6.

Illumination of library reading space:

Area=4877.6563 ft^2/432.53 m^2

Average illumination=300 Lux

Total flux=432.53*300=129759 Lumen

Required illumination = (129759)/(.75*.6)=288353.33 Lumens

If T5 24W 3ft 4000 lumens LED tube lights are used then…

Required number of lights = 72

Illumination of photocopy section:

Area=165.3125 ft^2/15.36 m^2

Average illumination=300 Lux

Total flux=15.36*300=4608 Lumen

Required illumination = (4608)/(.75*.6)=10240 Lumens

If T5 24W 3ft 4000 lumens LED tube lights are used then…

Required number of lights = 2

Illumination of assistant librarian's room:

Area=158.9236 ft^2/14.71 m^2

Average illumination=300 Lux

Total flux=14.71*300=4413 Lumen

Required illumination = (4413)/(.75*.6)=9806.66 Lumens

If T5 24W 3ft 4000 lumens LED tube lights are used then…

Required number of lights = 2

Conduit Length Calculation:

Specification as follows:

- The Height of the Light Bracket from the Floor Level = 8 Feet.
- The Height of the Switch from the Floor Level = 5 Feet.
- The Height of the 3-pin Switch Board from the Floor Level = 2 Feet.
- The Height of the Ceiling Fan from the Floor Level = 10 Feet.

Sl. no.	Switch Board	Conduit length (feet)
1	SB1	271.5375
2	SB2	263.645
3	SB3	325.255
4	SB4	39.185
5	SB5	34.05
6	SB6	32.83
7	SB7	21.74
8	Switches to SDB	77.038
9	SDB to MDB	36.416
	Total length	1102

Wire length and load calculation:

SWITCH BOARD 1: (Reading room)

Wire required = 282 ft

Live + neutral = 564 ft

Total wire = 564 + 564*10% = 621 ft

Ceiling fans of 75W = 8

Tube lights of 24W = 21

3 pin socket of 200W = 1

2 pin socket 100W = 1

Total wattage = 8*75 + 21*24 + 200 + 100 = 1404W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=1404/(220*.9) = 7.1A

With 10% overload =7.1 + 7.1*10%=7.81A

1.5 mm^2 (1/1.40) ,10A wire has of length 621 ft to be used for SB1

SWITCH BOARD 2: (Reading room)

Wire required = 274 ft

Live + neutral = 548 ft

Total wire = 548+548*10%=603ft

Ceiling fans of 75W = 5

Tube lights of 24W = 24

3 pin socket of 200W = 1

2 pin socket 100W = 1

Total wattage = 5*75 + 24*24 + 200 + 100 = 1251W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=1251/(220*.9) = 6.32A

With 10% overload =6.32+ 6.32*10%=6.952A

1.5 mm^2 (1/1.40) ,10A wire of length 603 ft has to be used for SB2

SWITCH BOARD 3: (Reading room)

Wire required = 335 ft

Live + neutral = 670 ft

Total wire = 670 + 670*10% = 737 ft

Ceiling fans of 75W = 10

Tube lights of 24W = 24

3 pin socket of 200W = 1

2 pin socket 100W = 1

Total wattage = 10*75 + 24*24 + 200 + 100 = 1626W

Assuming power factor as 0.9 and supplied voltage as 220V

Load = 1626/(220*.9) = 8.21A

With 10% overload = 8.21 + 8.21*10% = 9.031A

1.5 mm^2 (1/1.40), 10A wire of length 737 ft has to be used for SB3

SWITCH BOARD 4: (Photocopy section)

Wire required = 50 ft

Live + neutral = 100 ft

Total wire = 100 + 100*10% = 110 ft

Ceiling fans of 75W = 1

Tube lights of 24W = 2

3 pin socket of 200W = 1

2 pin socket 100W = 1

Total wattage = 1*75 + 2*24 + 200 + 100 = 423W

Assuming power factor as 0.9 and supplied voltage as 220V

Load = 423/(220*.9) = 2.13A

With 10% overload = 2.13 + 2.13*10% = 2.34A

1.5 mm^2 (1/1.40),10A wire of length 110 ft has to be used for SB4

SWITCH BOARD 5: (Assistant librarian's room)

Wire required = 45 ft

Live + neutral = 90 ft

Total wire = 90 + 90*10% = 99 ft

Ceiling fans of 75W = 2

Tube lights of 24W = 1

3 pin socket of 200W = 1

2 pin socket 100W = 1

Total wattage = 1*75 + 2*24 + 200 + 100 = 423W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=423/(220*.9) = 2.13A

With 10% overload =2.13+ 2.13*10%=2.34A

1.5 mm^2 (1/1.40),10A wire of length 99 ft has to be used for SB5

SWITCH BOARD 6: (Wash room)

Wire required = 43 ft

Live + neutral = 86 ft

Total wire = 86 + 86*10% = 95 ft

CSL lights of 12W = 4

Total wattage = 4*12 = 48W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=48/(220*.9) = .24A

With 10% overload =.24+ .24*10%=.264A

1.5 mm^2 (1/1.40) ,10A wire of length 95 ft has to be used for SB6

(Wash room)

Wire required = 32 ft

Live + neutral = 64 ft

Total wire = 64 + 64*10% = 71 ft

CSL lights of 12W = 2

Total wattage = 2*12 = 24W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=24/(220*.9) = .012A

With 10% overload =.012+ .012*10%=.0132A

1.5 mm^2 (1/1.40) ,10A wire of length 71 ft has to be used for SB6

SWITCHES TO SUB DISTRIBUTION BOARD:

Wire required = 88 ft

Live + neutral = 176 ft

Total wire = 176 + 176*10% = 194 ft

Total wattage =1404+1251+1626+423+423+48+24=5199W

Assuming power factor as 0.9 and supplied voltage as 220V

Load=5199/(220*.9) = 26.26A

With 10% overload =26.26 + 26.26*10%=28.88A

10 mm^2 (1/3.55) ,34A wire of length 194 ft has to be used

SUB DISTRIBUTION BOARD TO MAIN BOARD:

Wire required =47 ft

Live + neutral = 94 ft

Total wire = 94 + 94*10% = 104 ft

Total wattage = 5199W

Assuming power factor as 0.9 and supplied voltage as 220V

Load = 5199/(220*.9) = 26.26A

With 10% overload = 26.26 + 26.26*10% = 28.88A

10 mm^2 (1/3.55) ,34A wire of length 104 ft has to be used

Total length of wires:

1.5 mm^2 (1/1.40) ,10A wires :

SB1 = 621 ft

SB2 = 603 ft

SB3 = 737 ft

SB4 = 110 ft

SB5 = 99 ft

SB6 = 95 ft

SB7 = 71 ft

Total = 2336 ft

10 mm^2 (1/3.55) ,34A wire :

Switches to SDB = 194 ft

SDB to MDB = 109 ft

Total = 303 ft

Estimation of Conduits

25 mm diameter conduits of total length 1102 ft has to be used.

Cost Calculation

1. Wiring Material Cost:

Serial no.	Materials with specification		Quantity	Rate (Tk)	Total cost(Tk)
01	Conduit (25 mm dia)		1102'	12/feet	13224/=
03	1.5 mm^2 (1/1.40) ,10 A		2336'	8/feet	18688/=
04	10 mm^2 (1/3.55),34A		303'	12/feet	3636/=
06	Conduit	Outlet box	50 piece	20/ piece	1000/=
		Junction box	40 piece	40/ piece	1600/=
		Inspection box	20 piece	30/ piece	600/=
		Coupler	200 piece	6/ piece	1200/=
		Elbow	150 piece	3/ piece	450/=
	accessories	Tee box	25 piece	8/ piece	200/=
		Rectangular box	30 piece	6/ piece	180/=
07	3 pin 5-amp socket		6 piece	50/ piece	300/=

08	2 pin 5-amp socket	6 piece	20/ piece	120/=
09	Switch (250 v , 15 amp)	110 piece	20/ piece	2200/=
10	Switch board	7 piece	80/ piece	560/=
11	Tube light holder	75 piece	150/ piece	11250/=
12	Holder	75 piece	50/ piece	3750/=
13	circuit breaker (DS to SB)	7 piece	250/ piece	1750/=
14	Main circuit breaker	3 piece	300/ piece	900/=
15	Sub- distribution board	1 piece	500/ piece	500/=
16	Royal plug	70 dozen	6/ dozen	420/=
17	Screw	300 piece	0.5/ piece	150/=
18	G.I wire (pushing)	15 kg	100/ kg	1500/=
Total = 64178/=				

2. Additional Cost:

Serial No.	Item	Price per piece(Tk)	Required piece	Total price(Tk)
1	T8 Fluorescent Tube(CFL) (24W)	750	73	54750/=
2	Fan	2500	25	62000/=
4	CSL LED lights(12W)	220	6	1320/=

9	Regulator	25	22	220/=
Total =118290/=				

Labor cost=120 TK/load and plug point

Therefore, Labor cost = 120*113 = 13560/=

Finally, Total Cost: 64178+ 118290+13560 = 196028/=

REFERENCES:

1. S. L. UPPAL- "Electrical Wiring, Estimating & Costing".
2. http://www.energypack-bd.com
3. http://www.brbcable.com/price/price_list.pdf
4. http://www.en.wikipedia.org/wiki/Electrical_wiring
5. http://www.autodesk.com
6. http://www.jamunagroup.com.bd/electronics