REDESIGN OF ELECTRICAL NETWORKS

FOR

400 SEATER CAPACITY LT1 AUDITORIUM, GIDAN KWANO CAMPUS

BY

ALEGIEUNO ELLIS OSHOKHA

2001/11931EE

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE.

DECEMBER, 2009

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MATRIC NUMBER: 2001/11931EE

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BARCHELOR OF ENGINEERING (B.ENG) DEGREE IN ELECTRICAL AND COMPUTER ENGINEERING

THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING,

SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY,

MINNA, NIGER STATE.

DECEMBER, 2009.

DECLARATION

I,Alegieuno Ellis Oshokha,do declare that this project is as a result of my personal effort, and has never been presented elsewhere either wholly or partially for any degree in any institution of learning. All information gotten from both publish and unpublished works are fully acknowledged.

Ellis Alegre.   3/12/2009

Alegieuno Ellis Oshokha   Date

CERTIFICATION

This is to certify that this project "Redesign of Electrical Networks for 400 seater capacity LT1 (Auditorium), Gidan Kwano Campus", is the original work of Alegieuno Ellis Oshokha,carried out wholly by him under the supervision of Prof.Oria Usifo and submitted to the Department of Electrical and Computer Engineering, School of Engineering and Engineering technology, Federal University of Technology,Minna,Niger State,Nigeria.This work has been read and approved by

______________________ 7/12/09

Prof. Oria Usifo — Date

(Supervisor)

______________________ ______________

Engr.(Dr)Y.Adediran — Date

(H.O.D, Electrical & Computer Eng'g)

Ag. HoD (JAN. 19, 2010)

______________________ 09/03/10

External Examiner — Date

DR. (ENGR.) B.A. ADEGBOYEGA

DEDICATION

This project is dedicated to my parents: Chief &Mrs. Patrick Alegieuno, Dad and Mum you are wonderful, only God can reward you for me.

ACKNOWLEDMENT

My gratitude goes to God almighty for His inspirational support, strength and knowledge to carry out this project work successfully.

Special thanks go to my project supervisor, Prof.Oria Usifo and his assistant: Mal. Isah Doko, who carefully supervised this project and also for his very useful information, advice and guidance. I also want to acknowledge the effort of the HOD, Engr.Y.Adediran for his pep talk during the project.

To my parents,Chief &Mrs Patrick Alegieuno for their immense contribution to my studies all along may God continually reward you. I also acknowledge the moral and financial support of my daddies and mummies;Mr & Mrs Mike Alegieuno,Mr & Mrs M.B Olaiya, Mr & Mrs M.R Maiyegun, Mr & Mrs Alex Alegieuno, Mrs Debbie Katto. My gratitude also goes to my siblings and cousins;Kenneth,Patrick,Basil,Sandy,Richard,Henry,Joachim,Oshogwe,Bola,Toyin,Wumi,Patricia,Philomena,Anthonia,Judith,Gladys,Azemoh,Olumide,Nike,Toyin,Ola,Alfred, Emma loyin and others too numerous to mention.

I wish to specially acknowledge the following people ;JoyceAsimegbe,Nsikan,Esehile,kayode(Moon),Eze,Abdul(Shalams),Jonathan(J-Boy),Sarah David.Gladys,Ike,ilya Patience Ebike and others for their support and understanding. And finally to all my lecturers of the

Department who have contributed to my knowledge base, may God reward you all.

ABSTRACT

The purpose of this project is to design the electrical network design of LT1 (Auditorium, Gidan kwano).This is in view of the defects in the design and installation of electrical fittings for the auditorium.

This project shall be very useful as it seek to address the grey areas in the design and electrical installation work. It treated the calculations of illumination of the auditorium, the associated supply cables, the power loads for 13A and 15A socket outlets, as well as the calculation of the sub-main cables. The ratings of fuses were also specified for the Distribution Board. The minimum value earthing rod resistance was also determined.

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CHAPTER ONE

1.1 INTRODUTION

The need for an excellent job layout especially in the electrical networks of a building cannot be over emphasized as this tends to guarantee the safety of lives and property.

A well designed electrical network for any building, addresses issues as it pertains to safety, eliminate waste of resources, and arrest the problem of ill-equipped electrical contractors executing electrical design for buildings. It is against this backdrop that this project seeks to address.

This project is embarked upon to address some of the lapses observed in the electrical installation services of LT1 Auditorium in Gidan Kwano, hence to avert the danger of short circuit and earth fault which could result to loss of lives.

Electrical installation services are one of the major branches of electrical engineering. It involves the installation designs and procedures required in carrying out wiring job effectively. Electrical installation design may be prepared by an Electrical consultant for agencies, government, public or private enterprise.

1.2 AIMS AND OBJECTIVE OF THE PROJECT

This project is aimed at correcting the anomalies observed in the electrical network design of the auditorium (LT1) at Gidan Kwano.Prior to the design, it was discovered that the electrical fittings (Fan regulators, lighting Switches) were not fitted at an easily accessible place. The Earth Leakage Circuit Breaker (ELCB) and the Distribution Board (DB) were faulty. They need to be replaced with functioning ones.

The objective is to redesign the electrical networks of the auditorium to reduce the cost of electrical fittings required for optimal performance, avert hazardous conditions of short circuit, earth fault which could result to cause of fire; which is an imminent danger to human lives and properties.

1.3 METHODOLOGY

Generally, before the commencement of any building plan, an Architect is responsible to discuss the planning of her new building in this case the (Auditorium) with her client The University Management. The architect may ask questions such as;

a. What is the size and shape of your land?
b. Where is your parcel of land located?
c. What quality of materials do you wish to use?
d. What name brand of equipment do you prefer? e.t.c,

When these questions are adequately answered by the owner, the architect is ready to create a set of drawing s containing all the information and dimensions necessary to successfully execute the project. These drawings are referred to as working drawings reproduction of these drawings is called a set of Blueprints. The Architect uses this set of blue prints to convey instruction to all of the craftsmen who is to plan, erect and complete the structure. An Electrician is expected to be able to effectively read these blueprints with the right dimensions so that all of the outlets and equipment are located according to the blueprint.

The floor plan, shows the layout; windows, doors, also all the electrical outlets, equipment, devices and circuits. The working drawing tells the electrician how to proceed with the work of providing an efficient electrical installation

Specifications are a vital part of any building plan. They are the rules governing the type, kind quality and color of the materials to be used. The specifications enable the electrical contractor to estimate the bid in terms of legal responsibility guarantees, brand name and quality of materials required.

It is most pertinent for an Electrician to review all of the drawings and thoroughly understand specifications before starting the job

All the design work done in this project meet modern specifications and requirements, for instance ,the symbols used in representing the electrical accessories and appliances are up to date and more so, room for expansion on the load required is provided.

The building is to be wired by conduit wiring system because of its overwhelming advantages [1].A bill of quantities is included as well [2].

The design of lighting scheme; using the lumen method ,socket outlet determination of the distribution board(DB) rating ,Main Switch gear and correct cable size selection were calculated and also based on IEE Regulation[2].Effective protection of electrical design work is considered ;Testing and Inspection is incorporated in this project work[2]and are extensively discussed in chapter 4 after which a certification of completeness and inspection could be issued to the client by the designer of the installation[2].For longer services of the design work (wiring),a periodic or routine inspection and testing should be carried out effectively in accordance with IEE Regulations[2].

1.4 SCOPE OF THE PROJECT

The scope of this project is to redesign the electrical networks of Engineering Auditorium (LT1) Gidan Kwano; Areas of consideration include;

I. Determine the illumination of the auditorium
II. Repositioning of electrical fittings;i.e for switches and fan regulators to be easily accessible
III. Determine the power of 13A socket outlets
IV. Determine the power of 15A socket outlets
V. Determine the power of the distribution Board(DB)
VI. Determine the size of the cables to lamps

VII. Determine the size of cables to socket outlets
VIII. Determine the size of cables to the distribution board.
IX. Provide protection for all the cables in terms of fusing.
X. Provide earthing for the total installation work.

1.5 APPLICATION AND LIMITATION OF THE PROJECT.

The concept of redesigning is useful in electrical installation project that are adequately addressed. This is done to avert the possibility of fire, electrocution, earth fault e.t.c.

Some of the limitations encountered in the design of this project include;

I. Unavailability of the original blueprints for the Auditorium
II. There are no previous project works on electrical installation design in the department.
III. How to do market survey to get the most reliable pricing of electrical goods to execute the project.

CHAPTER TWO

2.1 LITERATURE REVIEW

In every electrical installation design work, safety, Economy, reliability, segregation of circuits and convenience are some of the factors to be taken into consideration. Therefore, it is the duty of the designer to make sure that these factors are considered when carrying out his/her actual design work. It should be noted that no particular factor should completely over-rule the rest factors, as all factors when considered it will bring about a good design work.

The importance of these aforementioned factors cannot be over emphasized. Therefore a brief discussion on their importance and relevance in any electrical installation is mentioned as follows:

A) SAFETY: Safety is a very important factor to be considered in every aspect of life. The life of man should be safe from electric shocks as well as damages to electrical components in an installation. The electrical materials used in the installation of a building should be save from easy damages due to fire, explosions, dampness etc. therefore, the electrical designer or contractor should be a major factor to be considered and his installation design should meet the safety requirements as specified in Regulation [1 – 10] of part 1 in the I.E.E Regulation. [19]

B) ECONOMY: Economy plays a major role in all aspect of our lives. Therefore in anything we do, we must take economy into consideration – this also applies to the electrical designer, the prevailing economy dictates to the designer, the quality and quantity of the materials to be used for the installation and how sophisticated the installation design should be, the time of completion etc. But no matter how the prevailing economy is, the required I.E.E regulation for building work must be met.

C) **RELIABILITY:** It will be uneconomical and unfair if after installing the electrical accessories and gadgets in a building, they fail to operate or function for a longer time as expected. The electrical designer should ensure that all safety devices incorporated in the installation of a building should be reliable thereby, functioning and operating when there is a fault or need be. Protective devices such as fuses, circuit breakers, earth-leakage circuit breakers should operate when they are suppose to operate due to fault arising from the circuit. The components or materials used in the electrical installation should meet the electrical and mechanical standard as specified by I.E.E regulation for building and components for longer lifespan and reliability.

D) **SEGREGATION:** Segregation of circuits is very necessary in electrical installation. It indicates how the various cables are grouped or separated for the various sub and final circuits in the installation and their control respectively the I.E.E Regulation [B45] encourages the separation of circuits. It states that, precaution shall be taken where an installation comprises of extra-low voltage (50V) as well as circuit operating at low voltage (exceeds 250V) and connected directly to a main supply, so as to prevent electrical contact between cables of various types of circuits. [20]

Proper labeling of fuses caters for a very good identification and particularly for good segregation of lighting and power circuits, the distribution board should be designed in a manner that currents can easily be identified when there is a fault.

Every final, sub-current should be arranged to operate the appropriate circuit it is assigned to control. Controlling circuit for lighting should not be incorporate in the same final sub-circuit with heating circuits. The controlling switches should be well located for easy identification of the lighting points they are controlling.

The designer most therefore, ensure that proper segregation of circuits in accordance with I.E.E Regulation [B53 and D14] is met.

E) **CONVENIENCE:** In every electrical installation, the designer must make sure that the materials or wiring accessories are placed in a position which is ideal and convenient for easy and better operation. After calculating the required number of socket outlets, lighting points, and their controlling switches using lumen method or point – to point method, the next thing is the proper positioning of these accessories at convenient points or places for their maximum usage. For example, lighting fittings are installed in position that would give good account of general illumination; switches for lighting scheme should easily be accessible. In an auditorium for instance, the lighting control switches should be located at each entrance. Fan regulators in an auditorium should equally be close to the entrance for easy access to turn-on or turn-off fans, and the regulators and fans should be properly label, for easy identification. It is better and safer to place the main breaker or switch gear at the centre of the load and good accessibility provided.

The I.E.E Regulation has given guidelines on the planning of lightning scheme and positioning of socket outlets. Therefore, the designer must incorporate all these guides in his/her design for the purpose of convenience.

F) **PROTECTION**

Protection is a very important topic in electrical engineering. Electrical accessories and gadgets must be protected against damages due to shocks, accidents, fire and faults within the circuit they are incorporate. The economy, safety, and reliability of the components or should be backed up with a solid and proper protection of the system. There are specifications given by I.E.E Regulation for building and components as regards the protection of an installation. The designer of any installation must therefore, meet these specifications and make sure that the right type of protective device is used for the particular system. It is protecting.

A protecting device must be reliable and should operate under fault conditions and as such must posses the following features.

1. Be sufficiently sensitive to detect a fault in its early stage.
2. Discriminate between currents fed to a fault within the section being protected and current passing through to a fault in another section.
3. Be simply durable.
4. Easy to adjust and test.

The hazards caused by shocks and fire to the lives of human beings and properties due to poor electrical protection system are so numerous and as such, installation designs must be properly protected to avoid damages both to the equipment and human beings. There are various types of faults in accordance with the I.E.E Regulation guiding them and will be discussed briefly as follows: [2]

A) EXCESS CURRENT PROTECTION

When there is an overload and short circuit in a circuit, excess current will be produced which is very dangerous to human lives and the electrical components also incorporated. And as such, an adequate protective device must operate to isolate the fault current in the circuit. There are two classification(s) of excess current protection recognized by the I.E.E Regulation. These are:

1. **<u>The coarse excess current protection</u>:** This uses the same type of fuses.
2. **<u>Close excess current protection</u>:** Mainly miniature and other circuit breakers and certain types of fuses. These protective devices operate within four hour circuit which they protect. Therefore, any electrical designer must provide the appropriate protection device.

B) <u>EARTHING</u>

The importance of earthing in electrical installation is to minimize the risk of shock to both lives and properties. An earth fault occurs in a circuit when the live of the circuit is licking the earthline due to poor insulation and will result in the production of excess equipment recommend that all circuits operating at a voltage exceeding extra low-voltage shall be protected against dangerous earth leakage currents. This may be achieved by: [3]

1. Completely insulating all parts of the system.
2. Double-insulation of appliance.
3. Earthing of exposed metal apparatus, the earth terminals of socket outlets and all metal work associated with wiring system with exceptions such as cable clips, lamp caps, metal chains for suspending lighting fittings etc.

In the protection of an earth fault, there are basic requirements given in the I.E.E Regulation to determine the particular protective device to be used. These are:

1. <u>THE USE OF FUSES OR EXCESS CURRENT – BREAKERS TO PROTECT EARTH FAULT:</u>

This type of protective device can be used it the earth fault current is available to operate the protective device and so make the faulty circuit dead.

i) 3 times the current rating of any semi-enclosed fuse or any cartridge fuse having a fusing factor exceeding 1.5 is used to protect this type of circuit.

ii) 2.4 times the rating of any cartridge fuse having a fusing factor not exceeding 1.5, is used to protect this type of circuit or,

iii) 1.5 times the tripping current of any excess current breaker is used to protect the circuit. Alternatively, when this requirement cannot be met, a suitable Earth Leakage Circuit Breaker (ELCB) should be installed.

2. **THE USE OF EARTH LEAKAGE CIRCUIT BREAKER TO PROTECT EARTH FAULT.**

This type of protective device is used where low enough earth impedance cannot be obtained. Either the current – operated earth leakage circuit breaker or the voltage – operated earth – leakage circuit breaker can be used.

2.2 WIRING SYSTEM

A network of wires connecting various accessories for distribution of electrical energy from the supplier meter board to the numerous electrical consuming devices is known as a wiring system. [1]

Wiring system consist of conductors, its insulation, its mechanic protection and the various accessories such as switches, socket outlets, fuse spur outlets, lamp holder, ceiling roses, pattresses, connectors etc. [3]. The types of wiring system are named mainly in terms of the mechanical protection offered.

In selecting a particular type of wiring system to be used for an installation, certain factors should be considered they include; [1]

i. The type of supply and earthing arrangement available.
ii. The probable maximum and minimum ambient air temperature in all parts of the installation.

iii. The possible presence of dust, vapour or gas

iv. The extent of mechanical protection required

v. The supply continuity and the provision of emergency supply in case of outage or for special use.

vi. Provision for future modification and rewiring during the life of the building.

vii. Probability of operating and maintenance cost taking into account the electricity supply tariffs available.

viii. The relative cost of various alternative methods e.g wiring in relation to the estimated life of the installation.

Other important considerations include, cost, safety and convenience.

The choice of any type of wiring depends on the desire of the client and designer after critically considering all the above conditions and also more importantly the I.E.E regulations for electrical installations.

The various types of wiring that are employed or used for electrical installations will be briefly discussed and more emphases will be laid on the conduit wiring system.

The choice of any wiring system for a particular installation should be based on technical and economic considerations, both in the context of the wiring system itself and the installation for which it is proposed.

2.2.1 TYPES OF INTERNAL WIRING SYSTEMS

There are several types of internal wiring system. They include: [3]

1. Cleat wiring
2. Wooden casing and capping wiring
3. CTS or TRS or PVC sheathed wiring

4. Lead sheathed or metal sheathed wiring

5. Conduit wiring

(a) Surface or open type

(b) Recessed or concealed or underground type.

2.2.2 CONDUIT WIRING

In this system of wiring, steel tubes known as conduits are installed on the surface of walls by means of saddles or pipe hooks or buried under plaster and VIR or PVC cables are drawn afterwards by means of a GI wire of size of about 18SWG. In damp situations the conduits can be spaced from the walls by means of small wooden blocks fixed below the pipes at regular intervals. In order to facilitate drawing of wires number of inspection fittings are provided along its length. The conduit should be electrically and mechanically continuous and connected to the earth at some suitable point. The conduit used for the purpose is of two types namely (1) light gauge (or split type) conduit and heavy gauge (or screwed type) conduit. Light gauge (or split type) conduit with a seam along its length is used for cheap work. It is not water tight and is not permitted on medium voltage (i.e. voltage higher than 250V). Screw conduit (solid drawn or with welded seam) is used for all medium voltages (250V to 600V) circuits and in places where good mechanical protection and absolute protection from moisture is desired.

Conduit size is slated in terms of its outer diameter. The smallest size is 12mm and the largest standard size is 63mm but this is not much in use. The numbers of cables of different wires that can be accommodated in various sizes of conduits are given in the table below. [1]

This system of wiring provides protection against fire, mechanical damage and dampness so this is the only approved system of wiring for:

a. Places where considerable dust or fluff is present

ii. Damp situation

iii. Places, where important documents are kept

iv. Residential and public buildings where appearance is prime.

2.3 WIRING MATEIRLAS AND ACCESSORIES

2.3.1 WIRES AND CABLES

Strictly speaking, single wire, may be bare or covered with insulation, is known as a wire [3] and several wires stranded together is known as a cable. But is practice bare conductor, whether single or stranded together are formed as wires and conductors covered with insulation are termed as cables.

The necessary requirements of a cable are that it should conduct electricity efficiently, cheaply and safely. This should neither be so small so as to cast too much. Its insulation should be such as to prevent leakage of current in unwanted direction and thus minimize risk of fire and shock.

2.3.2 TYPES OF CABLES USED IN INTERNAL WIRING

The wires employed for internal wiring of buildings are divided into different groups according to [3]

i. Conductor used

ii. Number of cores used

iii. Voltage grading and

iv. Type of insulation used.

According to the conductor material used in cables, these may be divided into two classes known as copper conductor cables and aluminum conductor cables.

According to the number of cores, the cable consists, three core cables, twin core cables, single core cable, two - core with ECC (Earth Continuity Conductor) cables etc.

According to voltage grading the cables may be divided into two classes: [3]

i. 250/440 volts cables and

ii. 650/1100 volts cables.

According to type of insulation the cables are of the following types: [3]

1. Vulcanized Indian – Rubber (VIR) insulated cables
2. Tough rubber sheathed (TRS) or cab type sheathed (CTS) cables.
3. Lead sheathed cables
4. Polyvinyl Chloride (PVC) cables
5. Weather Proof cables
6. Flexible cords and cables
7. XLPE cables.

2.3.3 VOLTAGE GRADING OF CABLES

This specifies the safe voltage which the insulation of the cable can withstand. The cables employed for domestic wiring are graded 650/1,100V.

MAIN SWITCH AND DISTRIBUTION BOARDS

According to IEE Regulation 476 – 15, a main switch or circuit breaker shall be provided for every installation which shall interrupt all live conductors of the installation, provided that for a 4 – wire three phase AC supply the linked switch or linked circuit breaker may be arranged to disconnect the phase connectors only and a link may be inserted in the neutral conductor; such a link shall be arranged so that it is in contact before the link switch can be closed or shall be securely fixed by bolts or screw .

Distribution Boards: The distribution board is an assembly of parts, including one or more fuses or circuit breaker arranged for the distribution of electrical energy to various circuits or other distribution boards known as sub-main distribution boards. Separate distribution fuse boxes should be provided for light and power circuits.

2.5 LIGHTING ACCESSORIES AND FITTINGS

There is a very large variety of lighting fittings and accessories available for installation work. Such fittings are collectively called accessories because they are accessories installation from the designer's and installer point of view.

In the complete electrical installation of a building the wiring and accessories are interdependent and neither can be fully understood without the other.

Below is a description of some of the accessories fitted during installation work.

1. **Switches:** A switch is used to make or interrupt a circuit. A complete switch consists of three parts. There is the mechanism, a box containing it and a front plate over it. The switch may be classified in various ways.

According to the type of base material they are classified as porcelain or bakelite switches. According to colour of base they are either white or black or brown coloured switches.

According to operation required they are classified as one-way switches, two-way switches, two-way centre-off switches, double pole switches etc.

Switches are rated 5A, 15A and 20A and are used to match the maximum anticipated load currents.

2. **Ceiling Roses:** The ceiling rose is used to connect the pendant lamps, fans, or fluorescent tubes to installation through flexible plastic or silk covered wire.
3. **Socket – Outlets:** A socket outlet is the correct name of what is popularly known as a power point. They used to supply electrical connection whenever required for electrical appliances such as TVs, Laptops, Amplifiers etc. sockets outlets are of two types; two pin type and three pin type. Majority of sockets are design for 13A maximum loads in domestic and commercial outfits. A part from the 13A sockets plugs, there are also sockets and plugs of 2A, 5A and 15A.
4. **Lamp Holder:** The lamp holder are used in public buildings and housing complex to house electric bulbs. They are meant for quick removal and replacement of lamps. They must hold the lamp firmly to prevent sparking which may lead to over heating of its surrounding.

Connectors: These are accessories is wiring system used of joining cables. In building system, no soldering conductor is done, hence the frequent use of cable connectors is employed. A connector block consist of two screws – down type terminals solidly connected to each other and mounted in an insulated casing. The screw is to grip the conductor slipped into it by tightening.

2.6 DETERMINATION OF NUMBER OF POINTS (LIGHT, FAN, SOCKET-OUTLETS)

The determination of number of light points is determined as per the size of the room, illumination level required and the luminous efficiency of the lamps to be used.

The number of fan points is determined as per measure (length, width and height) of the room and size of the fans to be used.

The air delivery for fans of different sizes at test voltage and at full speed is given in the table below. [3]

Fan size in mm	Type	Air delivery in m^3/minute
900mm	Capacitor ac dc	140 140
1,200mm	Capacitor ac dc	215 215
1,400mm	Capacitor ac Dc	270 270
1,500mm	Capacitor ac Dc	300 300

A regards the determination of number of socket-outlets, recommended schedule of socket-outlets is given below (Refer IS 4648-1986) [3]

Location	Number of 5A Socket-Outlets	Number Of 15A Socket-Outlets
Bed room	2 to 3	1
Living room	2 to 3	2
Kitchen	1	2
Dinning Room	2	1
Garage	1	1

Verandah	1 per $10m^2$	1
Bath room	1	1

2.7 DETERMINATION OF LOADS

. For determination of load of an installation rating may be assumed unless the values are known or specified.

(i) Fluorescent bulb 100watts

(ii) Incandescent lamps, fans and socket-outlets – 120watts

(iii) Power socket outlets – 100watts

2.8 DETERMINATION OF NUMBER OF SUB-CIRCUITS

The number of sub-circuit is decided as per number of points to be wired and total load to be connected to the supply systems.

In one light and fan sub-circuit the maximum load that can be connected is 800 watts and the maximum number of points which can be wire is 10. [3]

In one power sub-circuit the maximum load that can be normally connected is 3000 watts and the number of socket-outlets which can be provided is 2. [3]

2.9 DETERMINATION OF RATINGS OF MAIN SWITCH AND DISTRIBUTION BOARD

The current rating of the main switch is decided as per total current of the circuit to be controlled by it. The number of ways and current rating of the distribution board is decided as per the number of sub-circuits to be connected to it and current of the sub-circuit having highest current rating. [3]

2.10 DETERMINATION OF SIZE OF CONDUCTOR

There are three points, which must be taken into account, while determining the size of conductor. For internal wiring for a given circuit.

(i) Minimum size mainly mechanical reasons

(ii) Current carrying capacity of the conductor

(iii) The voltage drop along the conductor.

2.11 CALCULATING THE SIZE OF CABLES

The cables from final sub-circuits power socket outlets (13A and 15A) are usually standard cables and are given in table 4A and 5A, IEE wiring regulation of 15^{th} Edition

2.12 VENTILATION – ELECTRIC FANS – AIRCONDITIONING

VENTILATION

Ventilation of building is required to supply fresh air for respiration of occupants, to dilute inside air to product of combustion or other contaminants in air and to provide such thermal environments as will assist the maintenance of heat balance of the body to avoid discomfort and injury to health of occupants.

Certain factors govern the consideration of ventilation. They include:

(i) Supply of fresh air for respiration

(ii) Removal of combustion productions and preventions and prevention of ventilation by body odours.

(iii) Recommended schedule of values of air charges for various occupants, and

(iv) The limit of comfort and heat tolerance of the occupants.

There are various, methods by which a building with relatively large quantities of outside air could be used to used to improve the general environment of the building. This can be achieved by: [3]

(i) Natural supply and natural exhaust of air

(ii) Natural supply and mechanical exhaust of air

(iii) Mechanical supply and natural exhaust of air and

(iv) Mechanical supply and mechanical exhaust of air.

Reference can be made to:

IS: 3362 – 1977 for natural ventilation of residential buildings

IS: 3103 – 1975 for industrial ventilation.

2.12 FANS

Fans are primarily meant for accelerating or speeding up movement or flow of air, they are very useful in the ventilation process.

Fans can be broadly divided into two categories viz general purpose fans and industrial fans.

General purpose fans are meant for use in buildings and they include ceiling fans, table fans, exhaust fans etc.

Industrial fans are meant for use in factories for increasing amounts of fresh air for use in factories for increasing amounts of fresh air for use in industrial processes and include propeller fans, centrifugal fans, compressor fans etc.

For the purpose of this project, we shall be considering the ceiling fans

A ceiling fan is a propeller – bladed fan, having two or more blades, driven by an electric motor and provided with a device for suspension from a ceiling of a room so that the blades rotate in a horizontal plane and give uniform circulation of air in the room.

The ceiling fan is usually fitted with 3 or 4 blades, although a 4 – blade fan gives more air circulation than the 3 – blade fan. I would recommend the 4 – blade fans.

The desirable features of a ceiling fan are lighter in weight, cheaper in cost, low power consumption, longer life, excellent performance, noiseless operation and appealing outlook.

The number of fan points is determined as per measure (length, width and height of room (auditorium) and the size of the fans to be used. [3]

Below are the recommended air exchanges for ventilation per hour. [3]

RECOMMENDED AIR CHANGES FOR VENTILATION PER HOUR	
Assembly halls	8 - 12
Banks	4 - 8
Boiler houses	40 – 60
Canteens/Restaurants	12 – 20
Cinemas/Theaters	20 – 30

Factories/Workshops	12 – 20
Foundries	40 – 60
Kitchens	20 – 30
Laboratories	8 – 12
Lavatories	10 – 15
Photographic dark rooms	20 – 30
Hospital	8 – 12

Twice the number of air changes must be allowed where smoke occurs.

$$\text{Number of exhaust fans} = \frac{\text{Volume of space x air changes per hour}}{\text{Air delivery of fan per hour}}$$

For better air movement, distribute fans uniformly.

- Ordinarily 3 air – exchanges are expected to take place per hour in a room.

The air delivery for fans of different models, and different sizes along with other technical information at test voltage and at full speed is given below: [3]

Model	**Fan size in mm**	**Air delivery in m^3/Minute**	**Area covered in m^2**	**Distance between successive fans in meters**
3 – blade ceiling fan	900 1050	140 190	8.0 10.00	2.8 3.0

	1200	215	14.00	3.7
	1400	270	18.00	4.2
	1500	300	20.00	4.5
4 – blade ceiling fan	1200	225	15.00	3.5

Minimum distance from ground: 2.5 – 3 metres

Minimum clearance from ceiling: 300 – 400mm

Selection of ceiling fans [3]

S/No	Size of Room	Sweep of Fan
1	Small shapes, and low ceiling	600mm
2	Below $7m^2$	900mm
3	7 to $10m^2$	1,050mm
4	10 to $12m^2$	1,200mm
5	12 to $14.5m^2$	1,400mm
6	Large halls, offices, auditorium etc	1,500mm

For large size room, two or more ceiling fans may be a spacing of 2 to 3 sweep diameter between fan.

CHAPTER THREE

3.1 DESIGN ANALYSIS

The design of every lighting installation requires the knowledge of the following basic design data [1]

a) Plan and sectional drawing of the rooms

b) Details of ceiling construction

c) Colours of the walls and floors

d) Usage of the room

e) The furnishing or arrangement of machinery

f) Operating conditions such as the temperature, humidity, dust, e.t.c.

With the given basic design data, it is easy therefore, to select a suitable source of light and luminaire, the shape, the class, of protection and component part. Taking into consideration, architectural, maintenanceand physiological effect on the illumination requirement, the number of lamps could be calculated with optimum arrangement.

In the design of a lighting system, it is very necessary to select the lighting equipment that will provide the highest visual comfort and visual performance.

There are numerous factors that determine the choice of lighting equipment to be installed in a particular place, such factors include area to be lightened, light loss factors such as maintenance factor, coefficient of utilization, and other factors include the required illumination in flux, the flux produced by the fitting in lumens. Economy and energy efficiency are also factors that may dictate the choice of lighting system

3.2 FACTORS AFFECTING ILLUMINATION

3.2.1 MAINTENANCE FACTOR (MF)

The Maintenance Factor is a factor accounting for the ageing of lamps and the deterioration of the light installation due to dust and dirt deposit .This factor is commonly within the range of 0.6 – 0.9

The value of this factor in this design work is obtained from the Philips catalogue – Interior lighting design.

The reciprocal of this factor is called Depreciation Factor which is 1.25 [1]

3.2.2 COEFFICIENT OF UTILIZATION (CU)

This factor allows for the losses incurred by absorption of light by walls, ceiling, floors, and furniture in the lighting fittings. It affects the luminous output of a lamp on the working plane [1].

The value of coefficient of utilization for a specific type of lamp used can be obtain from the illuminating Engineering Handbook Table 14.4,page 157.Coefficient of Utilization can be found in this book if the ceiling cavity Reflectance (CRR),the wall Reflectance (WR),the Floor Cavity Reflectance (FCR)and the Room Cavity Ratio (RCR) are known.

3.2.3 ILLUMINATION LEVEL (E)

This is the number of lumen an object receives per unit area of its surface .The unit of illumination is the lux.

$E = I/A$

Where; · E is the illumination

I = luminous intensity

A =Area in square meters

The value of illumination E in lux used in the design is obtained from the Illuminating Engineering Society (I.E.S) Table 3 below

ILLUMINANCE CATEGORIES AND ILLUMINANCE VALUE FOR GENERAL TYPES OF ACTIVITIES

S/N	Types of Activity	Illuminance category	Range of 'Lux'	Illuminance Foot Candles
1	Public space with dark surrounding	A	20-50	2-5
2	Simple Orientation for temporary visit	B	50-110	5-10
3	Working spaces where visual task are only performed occassionally	C	100-200	20-50
4	Performance of visual task at medium contrast or small size	D	200-500	50-100
5	Performance of visual task at medium contrast or small size	E	500-1000	100-200

6	Performance of visual task of medium contrast or very small size.	F	1000-2000	

3.2.4 LUMINOUS FLUX (Q)

The lumen is the luminous flux falling on a unit area illuminated by a source with a luminous intensity per unit distance away. Since different lamps produce different values of lumen per watt, the value of lumen per watt can be obtained from the manufacturer's catalogue.

3.2THE LUMEN METHOD

The lumen method of calculation is used in the design of lighting scheme. The calculation is based on the average level of illumination desired over a given area. The lighting level of working plane, usually the height of work plane above the ground, for sitting is 0.75 meters and for standing 0.85 meters from floor level and covering the entire room floor area.

The average illuminance (intensity of illumination) E_{av}, is calculated from the formular[1]

$$E_{av} = \frac{Q \times MF \times UF}{A}$$

,lux

Where- Q_{tot} = the total luminous flux of the lamps

UF = Utilization Factor for the working plane

MF = Maintenance factor

A = Area to be illuminated

The number of lamps n is calculated to produce a specified illuminance by using [1]

$$Q_{tot} = \frac{E \times A}{UF \times MF}, \text{ lumen}$$

$$\text{Number of luminaries } N = \frac{\emptyset}{Lumen\ output\ per\ Lamp}$$

Where; - Q_l = the luminous flux of one lamp

N= the number of lamps per luminaries

N= the number of luminaries

3.3 ACTUAL DESIGN

The actual design work incorporates the design of lighting schemes and socket outlets for the auditorium, the total load required by the building hall, the determination of distribution rating, main switch gear and cable size selection and finally the system of power supply and load distribution.

Lighting points, socket outlets and the distribution board must be well positioned for convenience and with compliance to the IEE Regulation guiding fuse ratings should be installed to protect each final circuit .There should be a proper load balancing among the three phases for proper and undisturbed voltage power system in the building.

The estimation of the load required by this building is calculated in chapter 3.This can be obtained by taking the necessary diversity factor of each appliance or circuit into consideration as specified by the Table 4B of IEE Regulations

The proceeding parts of this chapter explain in detail how the actual design is carried out.

3.4 DESIGN CALCULATION FOR INTERIOR LIGHTING OF LT1 (AUDITORIUM),GIDAN KWANO

Desired illumination level= 250 lux [1]

I. **Auditorium Data**

Auditorium Length x = 25.664meters

Auditorium Width y= 14.230meters

Auditorium Height H = 6.5meters

Auditorium Floor Area =25.66m x 14.230m =365.199m^2

Mounting height =2.85m

Utilization Factor =0.75

Maintenance Factor = 0.8

Space/Height ratio of unity

Luminaire Recommended; 85Watts, AKT lighting 4U, Energy Saving Lamp []

Features;

- ✓ Saves energy 80% more than normal bulb
- ✓ Pure tri-color tube
- ✓ Life time more than 10,000 hours
- ✓ Instant Start

- ✓ High luminous efficiency
- ✓ Lamp Efficiency;40 lumens/Watts
- ✓ Protect your eyes
- ✓ Places to be applied;Shop,workshop,hotel,office,Restaurant,House,classroom.
- ✓ Using the lumen formula; -

$E_{av} = \frac{\emptyset \times MF \times UF}{A}$, lux (lumen/m2)

Total Lumen , $Q_{tot} = \frac{E \times A}{UF \ X \ MF}$, lumen

Where; $\emptyset_{tot}$=Lumen required=?

UF=Utilization Factor=0.75

MF=Maintenance Factor =0.8

A =Area covered =365.199m2

E_{av}=Illuminance level =250lm/m2

Q_L= Lamp Efficiency=40lumen/Watt

$\emptyset_{to} = \frac{250 \ x \ 365.199}{0.75 \ x \ 0.8} = 152166.25$ lumens

Lumen output per 85Watts lamp=85 x 40=3400

Number of Luminaires == $\frac{\emptyset}{Lumen\ output\ per\ Lamp}$

=152166.25/3400=44.75 = ≈45 luminaires

3.5 CALCULATING THE SIZES CABLES

1 **Final Sub-Circuits Cables;**

The cables from final sub-circuits power socket outlets (13A and 15A) are standard cables given in Table 4A and 5A of the IEE Wiring Regulations, 15^{th} edition.

3.5.1 LIGHTING AND FAN CIRCUITS

Each of the lighting circuit is recommended to carry 9Nos. of 100Watts lamps

9 x 100 = 900Watts as maximum power.

Taking phase Voltage 230volts

Power/Phase =9 x 100 =900Watts

Current/Phase =900/230= 5.32A

Fuse rating =10A$_{mp}$

From table 9D2, of the IEE Regulations,15^{th} Edition, A 1.5 mm2 PVC twin core cable which can carry 18A Volt drop/A/m = 28mV

Ambient Temperature = 40 C

Length of cable/circuit = 32 .78meters

Temperature Correction Factor= 0.87

Applying the correction factor, current, $I=\frac{5.217}{0.87}$ = 5.99 = 6A

Fuse rating =10A$_{mp}$

Testing for voltage drop effect

Voltage drop= I x L x V

Voltage drop = 5.217 x 32.78m x 28mV/A/m= 4.79V

Permitted Voltage Drop 2.5% of 230 = 5.75V

Therefore a 1.5 mm2 size cable is chosen for each lighting and fan circuit.

A) 13A SWITCH SOCKET OUTLRT POWER CIRCUITS

Assume one 13A Switch Socket outlet 300Watts load,

One 13A Ring circuit has 4 numbers of 13A Socket Outlet

= 4 x 300Watts =1200Watts

Voltage/Phase/Circuit=230V

Current/Phase/circuit=$\frac{1200}{230}$ =5.217A

Length of Cable/circuit = 18.51meters

Ambient temperature =40C

Temperature correction factor =0.87

Applying correction factor, I =$\frac{5.217}{0.87}$ =5.99A

Fuse rating =30A

Chosen cable size,2.5mm^2 with 17mV/A/m and current carrying capacity of 24A

Therefore, voltage drop =I x L x V =5.217 x 18.51m x 17mV/A/m=1.64V

Permitted voltage drop =2.5% x 230V =5.99V

Since Voltage drop, 1.64< 5.99V, a 2.5mm2 cable is chosen for the 13Asocket outlet.

3.5.4 CALCULATING THE SIZE OF THE CABLE FROM THE AC DISTRIBUTION PANEL TO THE DISTRIBUTION BOARD

Assumed length of cable=25meters

Ambient temperature =40C

Temperature correction factor =0.87

Maximum Demand load (3-Phase)P_T =24660VA

Nominal Voltage=400V

Hence current per phase, I=P_T/√3V

Applying correction factor, I =34/0.87 =39.08A

Fuse rating =60A

Chosen cable size, 16mm2 with 62A and 2.3mV/A/m is recommended [2]

Therefore, voltage drop =I x L x V =39.08 x 25m x 2.3mV/A/m=2.247V

Permitted voltage drop =2.5% x 230V =5.75V

Since Voltage drop, 2.247< 5.75V

Hence, 1x 4 x 16mm^2 cables will be the size of cable to the Distribution Board.[2]

3.6DETERMINATION OF POWER TO THE DISTRIBUTION BOARD(A)

Calculations

Total 3-phase load=24,660Watts

Voltage =400Volts

P=√3x V x I x CosØ

Current, I=P/√3 x 400 x 0.8 = 24660/1.73 x400 x 0.8=44.54A

Maximum demand with overall diversity factor of 0.5

=0.5 x 24, 660=12,330VA

For the purpose of determining the a suitable Distribution board, a 60A TP&N 8-Way MCB DB of mixed capacity is recommended, haven carried out calculation for current, 44.54A.

, for implementation and for future expansion

LOAD ESTIMATION

This is an estimation of the total load required by an installation at a particular period or time. Load estimation helps us to know the total load required by the building installation so that the appropriate rating of switch gear, Distribution Board (DB) and the size of cables required can be determined. Load estimation will aid us in proper balancing of loads in the installation for effective power or voltage operation.

Below is a table showing the total load estimation carried out for Lecture Theatre (1) Auditorium, Gidan-kwano

S/No	Appliance	Type	No. of Points	Power Demand based on IEEE
1	Lamp	Fluorescent Bulb	45	4500
2	Fans	Ceiling fan	18	2160
3	13A Socket	Ring Circuit feeding 13A	12	
4	15A Socket	15A A/C Socket outlet	6	12000
5	Air Conditioners	2.5hp Split Unit AC	6	15000

<u>For 15A Socket Outlets</u>

Power P= 6 x 2000=12000Watts

Voltage, V=230 Volts

Current, $I = \frac{12000}{230} = 52.17A$

Diversity Factor is not applicable.

For Ceiling fans

Power P= 18 x 120=2160Watts

Voltage, V=230 Volts

Current, I=$\frac{2160}{230}$ = 9.39A

There is no Diversity Factor.

For Fluorescent Fittings

Power,P=45x 100Watts =4500Watts

Current,I=$\frac{4500}{230}$ =19.56 x1.8=35.22A

Applying Diversity factor of 0.522, maximum current demand,

Current,I=0.522 x 35.22 =28.17A

For Air Conditioning Split Unit

Power,P=6 x 2500Watts =15000Watts

Current,I=$\frac{15000}{230}$ =65.2A

Applying Diversity factor of 30%, maximum current demand,

Current, I=0.3 x 65.2 =19.56A

For Ring Circuit (13A Socket)

Power, P = 12 x 300Watts =3600Watts

Current, $I = \frac{3600}{230} = 15.652A$

Applying Diversity Factor of 0.3

Current, I=0.3 x 15.65 =4.69A

Total current required for this installation will be

15A Socket---52.17A

Ceiling Fans---9.39A

Fluorescent Bulb fitting------------------------------------28.17A

Air conditioning Split Unit---------------------------------19.56A

Ring circuits---4.69A

Total Current demanded--------------------------------------113.98A

3.7.1 DETERMINATION OF SWITCH GEAR TO BE INSTALLED

$$\text{Switch Gear rating} = \frac{\text{Total Current}}{\text{No. of phased Installed}}$$

$$= \frac{113.98}{3} = 37.99A$$

Hence, the switch gear that is suitable for this auditorium is 60Amps. Triple Pole and Neutral switch gear in 3-Phase, 4-Wire in anticipation for future expansion.

Cable Size of switch gear

From the table 9D1 of the 15^{th} Edition of IEE regulation for Electrical Installation, the size of cable to be used is 16mm2 PVC single core cable corresponding to the 60A.

CHAPTER FOUR

4.1 RESULT AND DISCUSSION

I would like to begin my discussion by asking and answering a few questions the reader may wish to know as it pertains the design.

What is the first thing to do when one is asked to design the electrical network for a building?Firstly,get the floor plan of the building, plot how best to energize the building electrical fittings, design the power layout, lighting layout and strategically locate them in conformity with IEE wiring regulations for buildings.

For the lighting layout, I choose certain values for my calculations; illuminance, Diversity Factor, Coefficient of Utilization, Maintenance Factor. For illuminance, the amount of light falling on an area "A" of a surface, 250 lumen/m2 is within the recommended illuminance range for General Classroom interior lighting.[1].Maintenance Factor, of 0.8 was selected considering the lighting output could be reduced reasonably due to dust and dirt on the fluorescent bulb[1].A coefficient of Utilization of 0.75, which takes care of the utilized flux reaching the working plane. Diversity Factor of 0.5 enables us to estimate the maximum demand (MD) at any time, the reason being that it is unlikely that the loads will all be used together. The loads are thus diversified.

The question as to why I choose the drop down fluorescent bulb over the conventional fluorescent tube? Recent studies shows that that the fluorescent bulb last longer an average of (10,000hours) ,maintenance cost is low, consumption of power is lower; no choke problem, has a higher lamp efficiency[8].

The spacing to height ratio of unity, 2.85meters apart was adopted for local uniformity and constant intensity. It is a function of the type of lighting fitting and illumination needed on a working environment.

I would like to talk about what the project seek to address? It tells us that there are other ways of designing the electrical network of this building; that will bring about greater efficiency of installed electrical networks of this building, that will bring about greater efficiency of the installed electrical fittings, accessibility to fitting, because that is not the case at present. Fan regulators, lighting switches and socket outlet are not properly positioned. The best place would be at each entrance, closest to the fittings.

What are the new things I incorporated in my design that the existing one does not have. ? Firstly, I changed the lighting scheme, using fluorescent bulb, due to greater efficiency. I decided to use the serial lighting circuit with a two-way switching pattern, such that aleast lights *could be switched 'on' or 'off'* at any of the *four entrance point of* the hall.

Secondly, I designed my 13A ring circuit, such that it is evenly distributed for users to find some comfort.

Thirdly, I made provision for 6 split unit Air conditioner units to be installed with each taking its source from a 4-way AC panel and a 45A switch gear for switching it "on" and "off"

Why did I have to energies the entire network with a 3-phase power supply? I choose this, owing to the large amount of power required to power my fittings and to bring about stability and redundancy of the power system

What are some of the reasons why some electrical fittings installed are failing and how do we remedy the situation? When equipment is not tested periodically, protective devices such as the Earth Leakage Circuit breaker should be routinely tested. To avoid components, such spring from losing her tensile strength.

What are the various test are to take to guarantee the workability of my design? The test to be performed before a new installation or an addition to an existing installation is connected to the supply mains (i) insulation resistance between the wiring and earth, with all fuses and in and all switches 'on' (ii) test of polarity of non – linked single pole switches (iii) Test of earth resistance..

Why did you decide to use an 8-way Distribution panel? I choose an 8-way distribution board panel because I only needed 6 out of the 8 way to power my circuit, while the remaining 2 are spare for expansion.

What DB panel cable size is appropriate for this design and why? By my calculations, in Chapter three, considering the magnitude of current, the cables that will carry 40A, with reference to IEE regulations a cable of 25mm2 with a 95A,1.6mV/A/m is the most appropriate. Hence a 1 x 4 x16mm2 cable will be the size of cable to the distribution board panel.

I decided to use the 13A socket outlet 15A outlet side-by-side because of anticipated heavier loads could be connected to the 15A socket outlet which has a higher cable rating(4mm2)

What are my criticism about the present power layout and light layout? Firstly, why is the socket outlets concentrated at the front and back of the auditorium? Suppose,one is at the middle of the auditorium how would he/she have access to a socket outlet?Seconly,for the lighting layout they made use of a 1 x 4 recessed modular fluorescent luminaire.which is more expensive, but virtually all the bulbs are not working. I would rather go for light this highly efficient.

What were my shortcoming/limitations of this project?

It was about getting the blueprint of the auditorium I wrote to the school planning unit, but to no avail I later consulted an architect to do one for me.

CHAPTER FIVE

5.1 CONCLUSION AND RECOMMENDATION

5.2 CONCLUSION

The difference between my design layout and the existing one executed by the electrical contractor is that they were more concerned with aesthetics as against optimal performance of the electrical installations implemented, whereas during my redesign, I considered safety, cost, accessibility of electrical fittings (Switches, Fan Regulators, Switch gear, Electric Circuit breaker,e.t.c).I made provision for Air Conditioning cooling system, efficiency (low power consumption fittings)

5.3 RECOMMENDATIONS

- ✓ Electrical contractors' designs should be thoroughly scrutinized by seasoned engineers in the university to ensure implementation that will stand the taste of time.
- ✓ Routine testing and inspection of all electrical fittings should be carried out periodically and faults rectified as quickly as possible.
- ✓ An overhaul of the entire electrical fittings in this auditorium should be carried
- ✓ Professional should always be called upon with track record of excellence, when projects of this magnitude are to be carried out.

REFERENCES

[1] Oria Usifo, Electrical Networks Design and Installation in buildings,2nd Edition,Fredorus Ltd.,Publishing Division, Benin City,Nigeria,1998, pp220

[2] IEE Wiring Regulations; Regulations for Electrical Installations, Fifteenth Edition 1981 pp220

[3] J.B Gupta, Electrical Installation Estimating and Costing,8th Edition,S.K. Kataria & Son, Publishers of Engineering and Computer Books,Nai Sakak Delhi, India, 2005, pp498

[4] Illuminating Engineering Society (I.E.S) –www.iesna.org site visited on 20th July, 2009 at 12:45pm

[5] Lighting Handbook –http://scribd.com/lighting –handbook, site visited on 20th July, 2009 at 7:30pm

[6] H.P Richter & W. Creighton Schwann, Practical Electrical wiring Residential,Farm & Industrial, Fifteenth Edition, Wiley publishers, Los- Angeles,U.S.A, 1990. Pp720

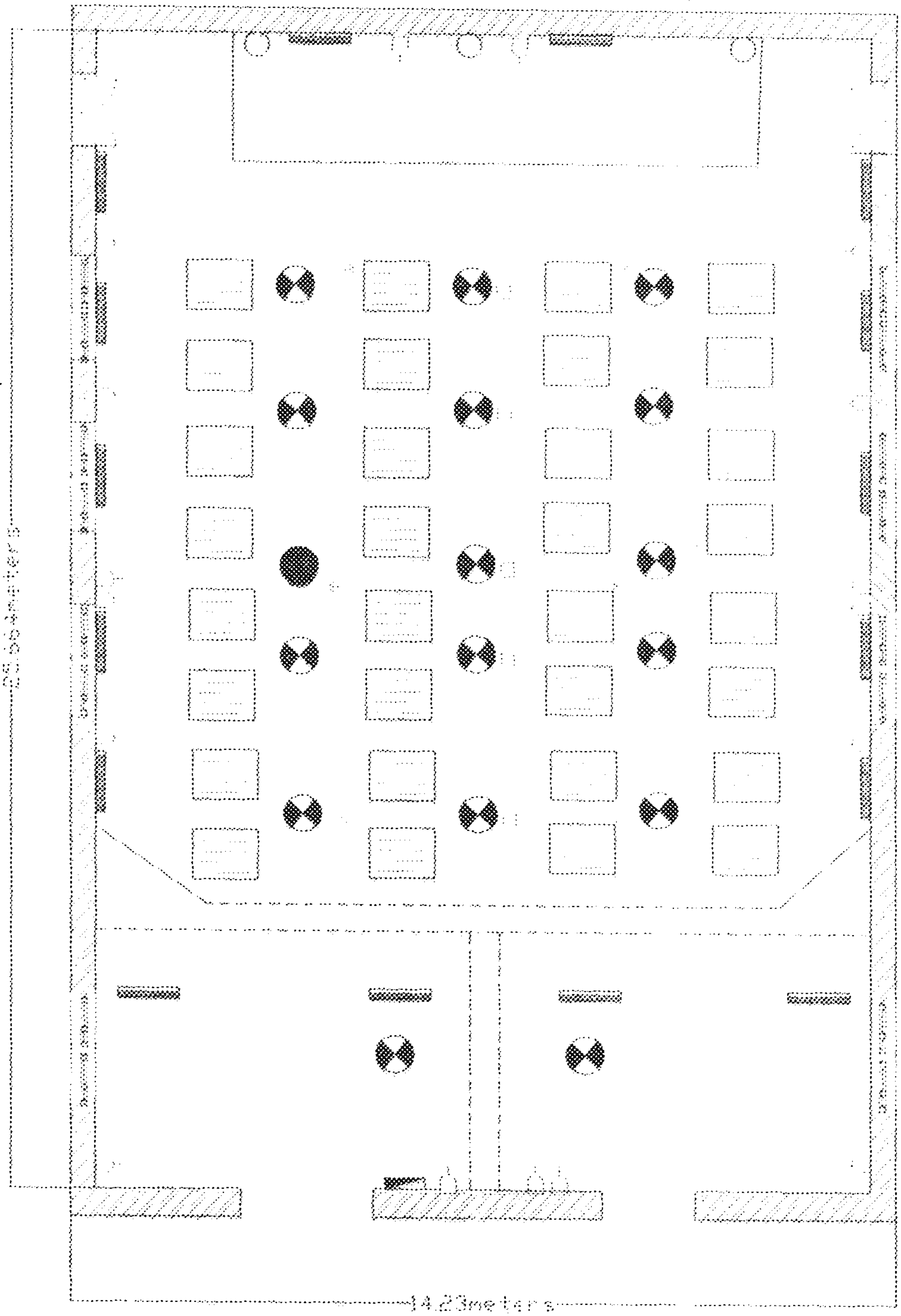
[7]How products are made Vol. 2 –www.howstuffworks.com visited site on 8th August, 2009 at 12:08am

[8] Zhongshan AKT Lighting Electrical Co.Ltd- www.aokete.com visited on 16th November,2009 at 7.01pm

KEY.

CAT NO.	SYMBOL	DESCRIPTION.
CAT NO.		(4 X1) modular recessed fluorescent fitting
		1.2meters fluorescent Wall mounted fitting
NEWCLIME		3 -blades, ceiling fan.
		Halogen lamps.
AHUJA		Speakers.
FEDERAL		Distribution board.
MK		15A single socket outlet.
MK2747WHI		13A single socket outlet.
		Emergency light (rechargeable)
MK4870WHI		10A, 2 gang, 2 way flush switch
MK4871WHI		10A, 3 gang, 2 way flush switch
AKT-4U		85W AKT lighting 4U, energy saving lamps
AHUJA		Public address system
NATIONAL		Split unit air conditioner, 18000BTU (2.5Hp)
		Dual chamber ionization smoke detector
		Exit lamps
		ELCB

ALBERUNO ELLIS	PROJECT : REDESIGN OF ELECTRICAL NETWORK FOR LT (AUDITORIUM) GIDAN KWANO CAMPUS.	DRAWING TITLE	LEGEND
ALBERUNO ELLIS		DATE	DEC 2009
	CLIENT: FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA	SCALE	NTS
		SHEET NO	01



EXICTING PLAN FOR LIGHTING AND POWER POINT LAYOUT

[illegible]	PROJECT : [illegible]	DRAWING TITLE	LIGHTING AND POWER LAYOUT
[illegible]		DATE	[illegible]
	CLIENT: FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA	SCALE	NTS
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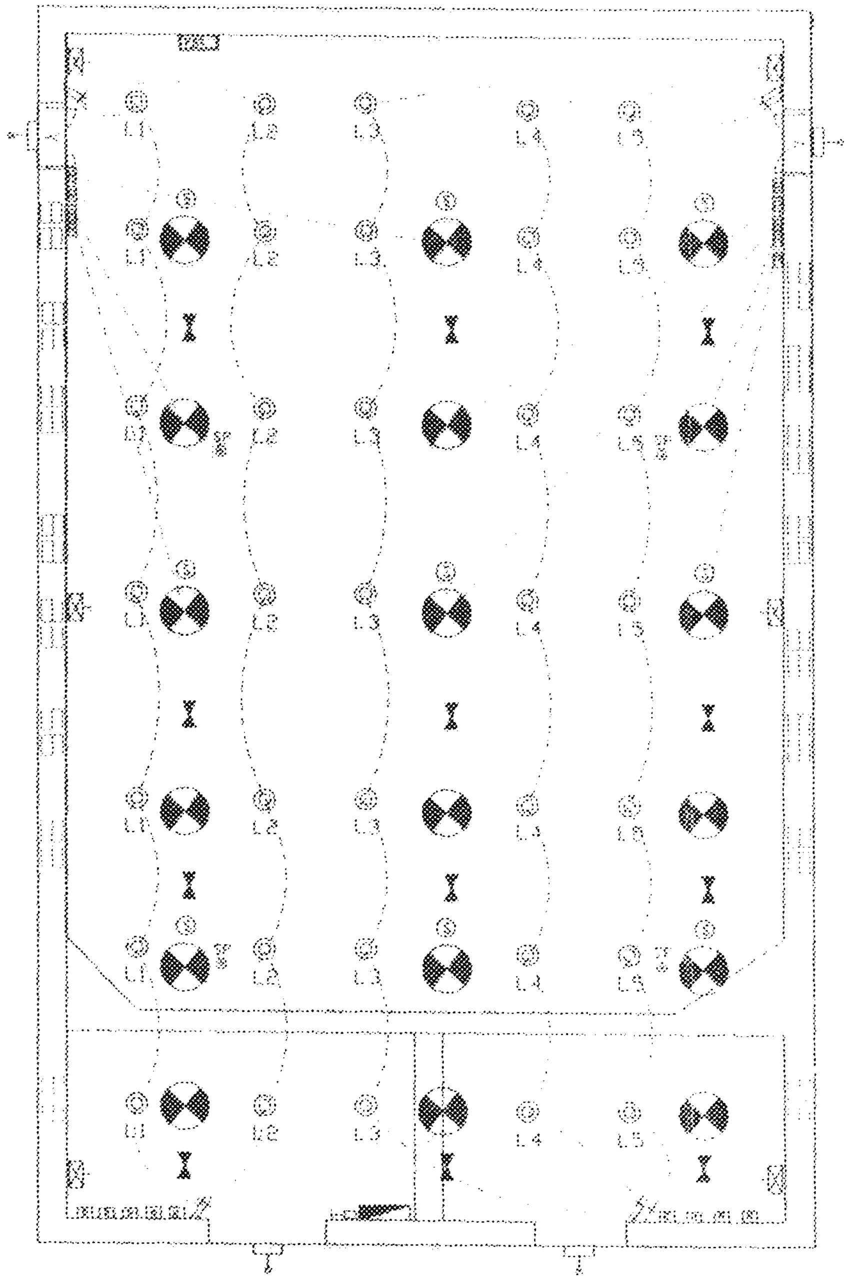
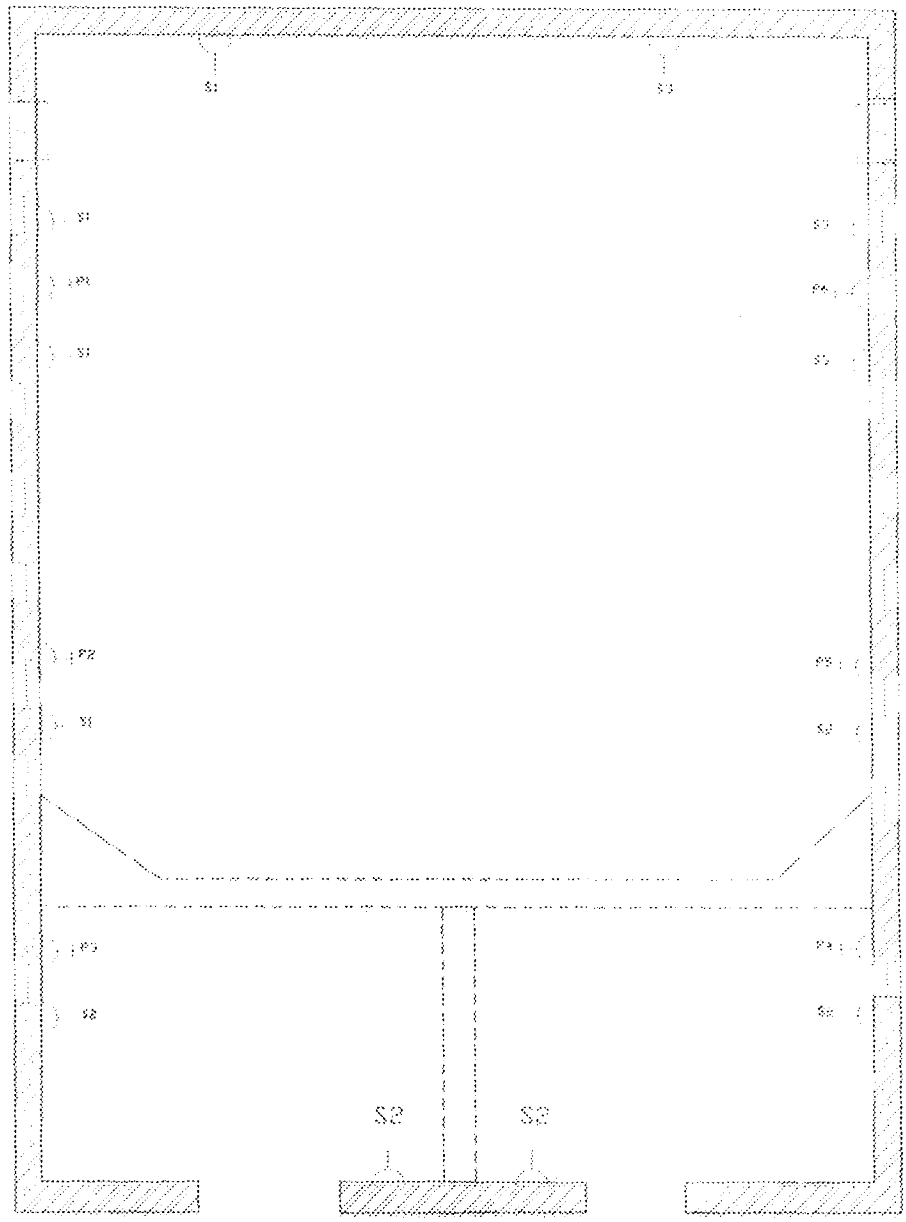


ALEGBUNO ELLIS	PROJECT : REVISION OF ELECTRICAL NETWORK FOR LT1 (AUDITORIUM) GIDAN KWANO CAMPUS	DRAWING TITLE	LIGHTING AND POWER LAYOUT
ALEGBUNO ELLIS		DATE	DEC 2009
	CLIENT: FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA	SCALE	NTS
		SHEET NO	04

POWER SOCKET OUTLET



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[illegible]		DATE	DEC 2009
	CLIENT: FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA	SCALE	NTS
		SHEET NO	05

LOAD SCHEDULE FOR DISTRIBUTION BOARD

cuit .	Cable Size (mm^2)	Fuse /MCB Rating	Code	Description of Fitting	No. of Fitting	Watt per point	Power Factor	Diversity. Factor	Total load per phase(VA) R	Y	B
	1.5	10	L1	85W AKT Energy Saving Lamps	9	100W	1	0.522	900		
	1.5	10	L2	85W AKT Energy Saving Lamps	9	100W	1	0.522		900	
	1.5	10	L3	85W AKT Energy Saving Lamps	9	100W	1	0.522			900
	1.5	10	L4	85W AKT Energy Saving Lamps	9	100W	1	0.522	900		
	1.5	10	L5	85W AKT Energy Saving Lamps	9	100W	1	0.522		900	
	2.5	30	S1	13A Socket Outlet	4	300W		1.3			1200
	2.5	30	S2	13A Socket Outlet	4	300W		1.3	1200		
	2.5	30	S3	13A Socket Outlet	4	300W		1.3		1200	
	4.0	20	P1	15A Socket Outlet	1	2000 W		NO DIV			2000
	4.0	20	P2	15A Socket Outlet	1	2000 W		NO DIV	2000		
	4.0	20	P3	15A Socket Outlet	1	2000 W		NO DIV		2000	
	4.0	20	P4	15A Socket Outlet	1	2000 W		NO DIV			2000
	4.0	20	P5	15A Socket Outlet	1	2000 W		NO DIV	2000		
	4.0	20	P6	15A Socket Outlet	1	2000 W		NO DIV		2000	
	1.5	10	F1	3-Blade Ceiling Fan	9	120W		NO DIV			1080
	1.5	10	F2	3-Blade Ceiling Fan	9	120W		NO DIV	1080		
				Spare						1200	
				Spare							1200
				Spare							
				Spare							
				Spare							
				Spare							
				Spare							
				Spare							
	TOTAL LOAD PER PHASE								8080	8200	8380
	TOTAL 3 PHASE LOAD=24,660VA										
	OVERALL DIVERSITY FACTOR =0.5, MAXIMUM DEMAND =12,330VA										

SCHEMATIC DIAGRAM DISTRIBUTION BOARD PANEL (A)