MAJOR PROJECT

REPORT ON

DESIGN, ANALYSIS AND FABRICATION ELECTRICITY GENERERATED BY CEILING FAN

An Main-project report submitted in partial fulfillment of the requirements for the

Award of the degree of

BACHELOR OF TECHNOLOGY

in

MECHANICAL ENGINEERING

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CERTIFICATE

This is to certify that the Major project Report entitled DESIGN,ANALYSIS AND FABRICATION OF ELECTRICITY GENEREATED BY CEILING FAN that is being submitted by **B.NAVEEN KUMAR-20671A0306, B.NIKHIL-20671A0309, CH.PRANAY-20671A0311, CH.TEJA-20671A0312** partial fulfilment for the award of **Bachelor of Technology in Mechanical Engineering** to the **J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY(AUTONOMOUS), HYDERABAD,** is a record of bonafide work carried out by him / her under our guidance and supervision.

Signature of the Supervisor	**Signature of HOD**
Mr.A.SAI KUMAR	**Dr.ANOOP KUMAR**
Assistant Professor	Professor & HOD
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EXTERNAL EXAMINER

DECLARATION

I, B.NAVEEN KUMAR-20671A0306, B.NIKHIL-20671A0309, CH.PRANAY-20671A0311, CH.TEJA-20671A0312 here by solemnly affirm that the Main-project Report Stage-1 entitled intenship on DESIGN, ANALYSIS AND FABRICATION OF ELECTRICITY GENERETED BY CEILING FAN being submitted by me in partial fulfilment of the requirement for the award of the degree of Bachelor of Technology in Mechanical Engineering, to the J.B. Institute of Engineering & Technology, Hyderabad, is a record of bona fide work carried out by me under the supervision of
Mr.A.SAI KUMAR

Place: Hyderabad — Signature of Student

Date:

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This work is not an individual contribution till its completion. We take this opportunity to thank all for bringing it close to the conclusion. First of all, we would like to thank our guide Mr. A.SAI KUMAR for continuously assessing our work providing guidance by timely suggestions and discussion at every stage of this work. Thanks to, Dr. ANOOP KUMAR Head of Department of Mechanical engineering for providing all facilities without which this seminar work would not have been possible. We sincerely thank to Ms.P.SEEMARANI Assistant Professor for his guidance.

I would like to express my gratitude towards my parents & other faculty members of J.B. Institute of Engineering & Technology for their kind co-operation and encouragement which helped me in competition of this project

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ABSTRACT

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A fan is a machine used to create flow within a fluid, typically a gas such as air. The fan consists of a rotating arrangement of vanes or blades which act on the fluid. The rotating assembly of blades and hub is known as an impeller, a rotor or a runner. Usually, it is contained within some form of housing or case. Fans are the most used items in India despite the widespread availability of Coolers and air conditioners. Since the initial capital cost of solar systems is still quite high. When it comes to generate power for a domestic use and energy saving.Since energy generating is a major issue for mankind .This paper presents method of generating power by a ceiling fan. The generated power can be either used or can be stored in a battery for powering some other devices**.**

CHAPTER 1

INTRODUCTION

1.1 Introduction:

Fans are the most used items in India despite the widespread availability of Cooler's and air conditioners. Since the initial capital cost of solar systems is still quite high , when it comes to generate power for a domestic use and energy saving and energy generating is a major issue for mankind .This paper presents method of generating power by a ceiling fan . The generated power can be either used or can be stored in a battery for powering some other devices.

A wind turbine motor is used to generate electricity. Permanent magnet motor can be used as a generator for battery charging. The spinning shaft turns the electromagnets that are surrounded by heavy coils of copper wire inside generators. This creates a magnetic field, which causes the electrons in the copper wire to move from atom to atom, creating electricity. The voltage produced by a generator depends upon the number of turns in its coils, the strength of the magnet, and the rate at which the magnet turns. The more turns in the coils, the more voltage is produced.

DC dynamo which is used to generate current it will be interconnected with a ceiling fan through a mechanism in which the rotating ceiling fan motor will rotate dynamo's shaft. It will be connected in such a way that as the number of rotations of ceiling fan increases the rotation of the shaft of DC dynamo increases, by the mean time the voltage is also generated. The voltage generated will be given to high power LEDs.

1.2 Project Overview:

The project "**Ceiling Fan Based Power generation**" can be done using Ceiling fan, DC generator, Connecting Links. We can generate voltage with mechanical energy through Shaft drive.

1.3 Thesis:

The thesis explains the implementation of "**Ceiling Fan Based Power generation**". The organization of the thesis is explained here with:

Chapter 1 Presents introduction to the overall thesis and the overview of the project. In the project overview a brief introduction of "**Ceiling Fan Based Power generation**" and its applications are discussed.

Chapter 2 Presents the hardware description. It deals with the block diagram of the project and explains the purpose of each block. In the same chapter the explanation of Ceiling Fan, DC generator, High power LEDs are considered.

Chapter 3 Presents the advantages, disadvantages and applications of the project.

Chapter 4 Presents the results, conclusion and future scope of the project.

1.4 Ceiling Fan:

A **ceiling fan** is a mechanical fan mounted on the ceiling of a room or space, usually electrically powered, suspended from the ceiling of a room, that uses hub-mounted rotating blades to circulate air. Ceiling fans typically rotate more slowly than other types of circulating fans, such as electric desk fans. They cool people effectively by introducing slow movement into the otherwise still, hot air of a room. Fans never actually cool air, unlike air-conditioning equipment, they in fact heat the air due to the waste heat from the motor and friction, but use significantly less power (cooling air is thermodynamically expensive). Conversely, a ceiling fan can also be used to reduce the stratification of warm air in a room by forcing it down to affect both occupants' sensations and thermostat readings, thereby improving climate control energy efficiency.

The first rotary ceiling fans appeared in the early 1860s and 1870s in the United States. At that time, they were not powered by any form of electric motor. Instead, a stream of running water was used, in conjunction with a turbine, to drive a system of belts which would turn the blades of two-blade fan units. These systems could accommodate several fan units, and so became popular in stores, restaurants, and offices. Some of these systems survive today, and can be seen in parts of the southern United States where they originally proved useful.

The electrically powered ceiling fan was invented in 1882 by Philip Diehl. He had engineered the electric motor used in the first electrically powered Singer sewing machines, and in 1882 he adapted that motor for use in a ceiling-mounted fan. Each fan had its own self-contained motor unit, with no need for belt drive.[2]

Almost immediately he faced fierce competition due to the commercial success of the ceiling fan. He continued to make improvements to his invention and created a light kit fitted to the ceiling fan to combine both functions in one unit. By World War I most ceiling fans were made with four blades instead of the original two, which made fans quieter and allowed them to circulate more air. The early turn-of-the-century companies who successfully commercialized the sale of ceiling fans in the United States were the Hunter Brothers division of Robbins & Myers, Westinghouse Corporation and Emerson Electric.

By the 1920s, ceiling fans were commonplace in the United States, and had started to take hold internationally. From the Great Depression of the 1930s, until the introduction of electric air conditioning in the 1950s, ceiling fans slowly faded out of vogue in the U.S.,[2] almost falling into total disuse in the U.S. by the 1960s; those that remained were considered items of nostalgia.

Meanwhile, electric ceiling fans became very popular in other countries, particularly those with hot climates, such as India and the Middle East, where a lack of infrastructure and/or financial resources made energy-hungry and complex freon-based air conditioning equipment impractical. In 1973, Texas entrepreneur H. W. (Hub) Markwardt began importing highly efficient ceiling fans to the United States that were manufactured in India by Crompton Greaves, Ltd. Crompton Greaves had been manufacturing ceiling fans since 1937 through a joint venture formed by Greaves Cotton of India and Crompton Parkinson of England, and had perfected the world's most energy efficient ceiling fans thanks to its patented 20 pole induction motor with a highly efficient heat-dissipating cast aluminum rotor. These Indian manufactured ceiling fans caught on slowly at first, but Markwardt's Encon Industries branded ceiling fans (which stood for ENergy CONservation) eventually found great success during the energy crisis of the late 1970s and early 1980s, since they consumed far less energy (under 70 watts of electricity) than the antiquated shaded pole motors used in most other American made fans. The fans became very effective energy saving appliances for residential and commercial use by supplementing expensive air conditioning with a cooling wind-chill effect. Fans used for comfort create a wind chill by increasing the heat transfer coefficient, but do not lower temperatures directly.

FIG 3.2: CEILING FAN

"Delta" ceiling fan from the early 1980s.

Due to this renewed commercial success using ceiling fans effectively as an energy conservation application, many American manufacturers also started to produce, or significantly increase production of, ceiling fans. In addition to the imported Encon ceiling fans, the Casablanca Fan Company was founded in 1974. Other American manufacturers of the time included the Hunter Fan Co. (which was then a division of Robbins & Myers, Inc), FASCO (F. A. Smith Co.), and Emerson Electric; which was often branded as Sears-Roebuck.

Through the 1980s and 1990s, ceiling fans remained popular in the United States. Many small American importers, most of them rather short-lived, started importing ceiling fans. Throughout the 1980s, the balance of sales between American-made ceiling fans and those imported from manufacturers in India, Taiwan, Hong Kong and eventually China changed dramatically with imported fans taking the lion's share of the market by the late 1980s. Even the most basic U.S-made fans sold for $200 to $500, while the most expensive imported fans rarely exceeded $150.

Since 2000, important inroads have been made by companies such as Monte Carlo, Minka Aire, Quorum, Craftmade, Litex and Fanimation - offering higher price ceiling fans with more decorative value. In 2001, Washington Post writer Patricia Dane

Rogers[3] wrote, “Like so many other mundane household objects, these old standbys are going high-style and high-tech.”

Unlike air conditioners, fans only move air—they do not directly change its temperature. Therefore, ceiling fans that have a mechanism for reversing the direction in which the blades push air (most commonly an electrical switch on the unit's switch housing, motor housing, or lower canopy) can help in both heating and cooling.

Some ceiling fans, mostly Hunter ones made in or before 1984, are mechanically reversible (have adjustable blade pitch) instead of an electrically reversible motor. In this case, the blade should be pitched to the right (or left if the motor spins clockwise) for downdraft, and left (or right if the motor spins clockwise) for updraft. Hunter Hotel Original is one example. In very rare case, such as late 1984 Hunter Original, fans are both mechanically reversible and electrically reversible, in which case it can blow air up, or down, in either direction. Some ceiling fans can only blow air in one direction and are not reversible in any way, more often downdraft only, but rarely updraft only. It's the case on most antique fans, and most industrial fans.

For cooling, the fan's direction of rotation should be set so that air is blown downward (Usually counter-clockwise from beneath), unless in rare case in which more breeze would be felt when blowing upward, such as when it's installed in hallway where blades would be so close to the walls. The blades should lead with the upturned side as they spin. The breeze created by a ceiling fan speeds the evaporation of perspiration on human skin, which makes the body's natural cooling mechanism much more efficient. Since the fan works directly on the body, rather than by changing the temperature of the air, during the summer it is a waste of electricity to leave a ceiling fan on when no one is in a room unless there's air conditioning, open windows, or anything that can heat up the room (such as oven) and fan is just to move air around.[*citation needed*]

For heating, ceiling fans should usually be set to turn the opposite direction (usually clockwise; the blades should spin with the downward turned side leading) and on a low speed (or the lowest speed the fan is able to circulate the air down to the floor). Air naturally stratifies—that is, warmer air rises to the ceiling while cooler air sinks. Unfortunately, this means it is colder on or near the floor where human beings spend most of their time. A ceiling fan, with its direction of rotation set so that air is drawn upward, pulls up the colder air below, forcing the warmer air nearer the ceiling to move down to take its place, without blowing a stream of air directly at the occupants of the room. This action works to even out the temperature in the room, making it cooler nearer the ceiling, but warmer nearer the floor. Thus the thermostat in the area can be set a few degrees lower to save energy, while maintaining the same level of comfort. It is important to run the fan at a low speed (or a lowest speed the fan is able to circulate the air down to the floor) to minimize the wind chill effect described above. However if the ceiling is high enough, or the lowest speed downdraft would not create wind chill effect, it can be left on downdraft year around.

An additional use of ceiling fans is coupling them with an air conditioning unit. Through-the-wall/through-the-window air conditioning units typically found in rented properties in North America usually have both the tasks of cooling the air inside the room and circulating it. Provided the ceiling fan is properly sized for the room in which it is operating, its efficiency of moving air far exceeds that of an air conditioning unit, therefore, for peak efficiency, the air conditioner should be set to a low fan setting and the ceiling fan should be used to circulate the air.

1.5Parts of a ceiling fan

The key components of a ceiling fan are the following:An electric motor

Blades (also known as paddles or wings) usually made from wood, plywood, iron, aluminium, MDF or plastic

Blade irons (also known as blade brackets, blade arms, blade holders, or flanges), which hold the blades and connect them to the motor.

Flywheel, a metal or plastic or tough rubber double-torus which is attached to the motor shaft, and to which the blade irons may be attached. The flywheel inner ring is locked to the shaft by a lock-screw, and the blade irons to the outer ring by bolts that feed into tapped metal inserts. Rubber or plastic flywheels may become brittle and break, a common cause of fan failure. Replacing the flywheel may require disconnecting wiring and requires removing the switch housing that's on the way for the flywheel to be removed and replaced.

Rotor, alternative to blade irons. First patented by industrial designer Ron Rezek in 1991, the one-piece die cast rotor receives and secures the blades and bolts right to the motor, eliminating most balance problems and minimizing exposed fasteners.

A mechanism for mounting the fan to the ceiling such as:

Ball-and-socket system. With this system, there is a metal or plastic hemisphere mounted on the end of the downrod; this hemisphere rests in a ceiling-mounted metal bracket, or metal canopy, and allows the fan to move freely (which is very useful on vaulted ceilings). Some companies have come up with slight modifications of this design.

J-hook (Claw hook) system. A type of mounting system where the ceiling fan hangs on a metal hook, attached to the ceiling. A rubber grommet is used to keep the fan in place and helps avoid vibration on the ceiling.

- U-bolt system. Similar to J-hook system, except that the hook on the ceiling is U-shaped and is being held by screws. One advantage of U-bolt system as opposed to J-hook system is that it wouldn't unscrew itself by the fan's torque in either direction. J-hook can be unscrewed by the fan torque when spinning clockwise (or counterclockwise if J-hook is left-hand threaded).

- Some fans can be mounted using a low-ceiling adapter, a special kit which must be purchased from the fan's manufacturer. This eliminates the need for a downrod, and is therefore useful in rooms with low ceiling clearance.
- In recent years, it has become increasingly common for a ball-and-socket fan to be designed such that the canopy (ceiling cover piece) can optionally be screwed directly into the top of the motor housing; then the whole fan can be secured directly onto the ceiling mounting bracket. This is known as a "close-to-ceiling" mount or flush mount.

Other components, which vary by model and style, can include:

- A downrod, a metal pipe used to suspend the fan from the ceiling. Downrods come in many lengths and widths, depending on the fan type.
- A decorative encasement for the motor (known as the "motor housing").
- A switch housing (also known as a "switch cup" or "nose column"), a metal or plastic cylinder mounted below and in the center of the fan's motor. The switch housing is used to conceal and protect various components, which can include wires, capacitors, and switches; on fans that require oiling, it often conceals the oil reservoir which lubricates the bearings. The switch housing also makes for a convenient place to mount a light kit.

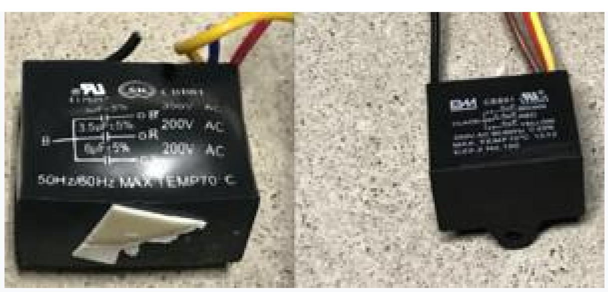


FIG 3.3:BATTERY

Ceiling fan capacitors. One on the left is swollen and worn out. One on the right is brand new and in good shape. Capacitor is used on PSC motor and is usually used to control the speeds, and tends to blow out a lot more often than motor does.

- Blade badges, decorative adornments attached to the visible underside of the blades for the purpose of concealing the screws used to attach the blades to the blade irons.
- Assorted switches used for turning the fan on and off, adjusting the speed at which the blades rotate, changing the direction in which the blades rotate, and operating any lamps that may be present.Lamps Uplights, which are installed on top of the fan's motor housing and project light up onto the ceiling, for aesthetic reasons (to "create ambiance").
- Downlights, often referred to as a "light kit", which add ambient light to a room and can be used to replace any ceiling-mounted lamps that were displaced by the installation of a ceiling fan.
- Decorative light bulbs mounted inside the motor housing—in this type of setup, the motor housing often has glass panel sections which allow light to shine though.

1.6 DC generator:

Generator principle

An electrical generator is a machine which converts mechanical energy (or power) into electrical energy (or power). Induced e.m.f is produced in it according to Faraday's law of electromagnetic induction. This e.m.f cause a current to flow if the conductor circuit is closed. Hence, two basic essential parts of an electrical generator are:

a) Magnetic field.

b) Conductor or conductors which can move as to cut the flux.

1.7 Simple loop generator

In fig.(1.1) is shown a single turn rectangular copper coil (AA′BB′) rotating about its own axis in a magnetic field provided by either permanent magnets or electromagnets. The two end of the coil are joined to two slip-rings which are insulated from each other and from the central shaft. Two collecting brushes (carbon or copper) press against

the slip-rings. The rotating coil may be called (armature) and the magnets as (field magnets).One way to generate an AC voltage is to rotate a coil of wire at constant angular velocity in a fixed magnetic field, fig. (1.1). (slip rings and brushes connect the coil to the load). The magnitude of the resulting voltage is proportional to the rate at which flux lines are cut (faraday's law), and its polarity is dependent on the direction the coil sides move through the field. The direction of an induced e.m.f can be predetermined by usingFlemings URUight-hand rule (often called the geneURUator rule) fig.(1.2).

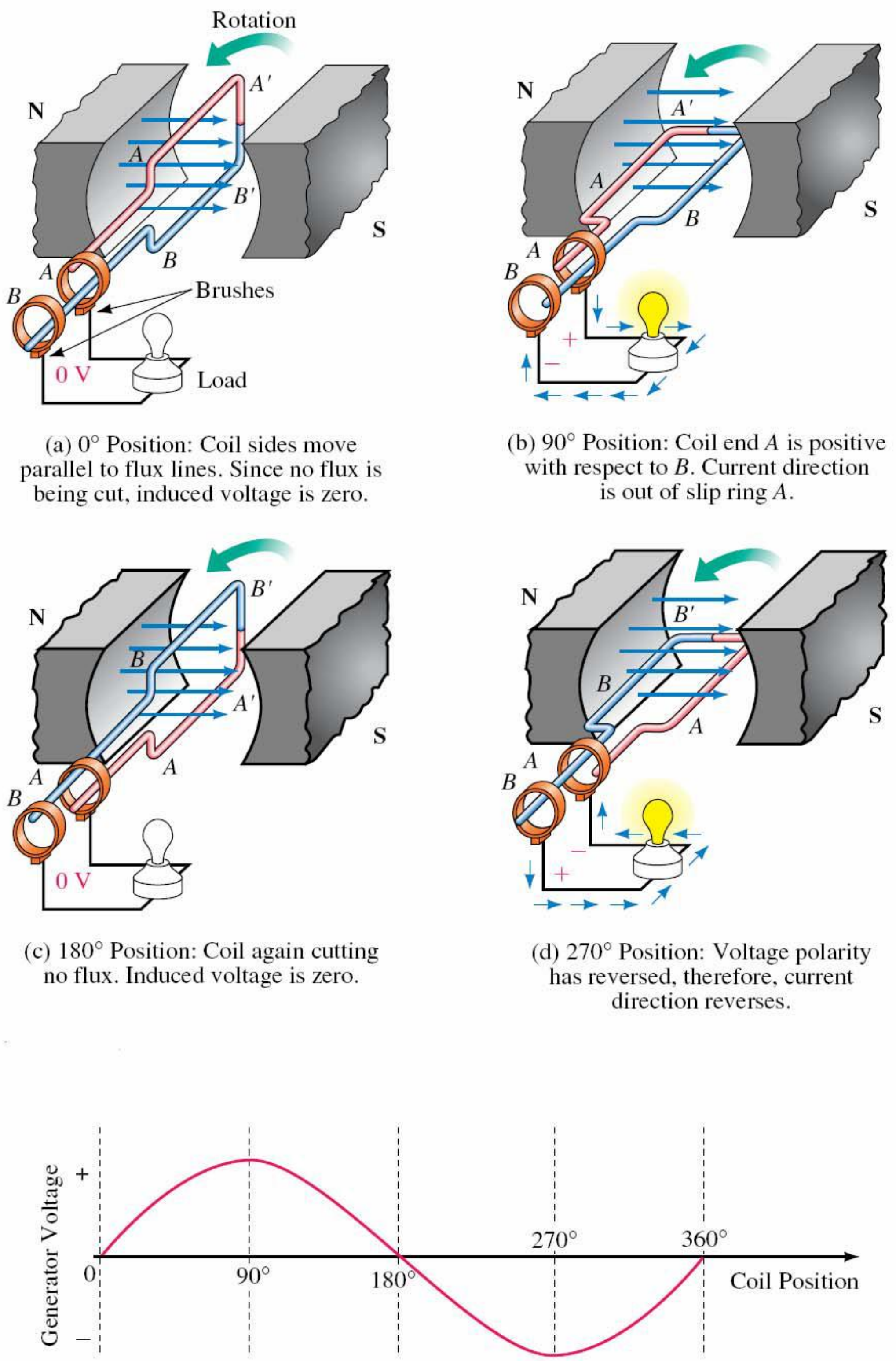
UFUirst finger- UFUield

ThuUMUb – UMUotion

sUEUcond finger – UEU.m.f

Since the rate of cutting flux varies with time, the resulting voltage will also vary with time. For example in (a), since the coil sides are moving parallel to the field, no flux lines are being cut and the induced voltage at this instant (and hence the current) is zero. (this is defined as the 0P°P position of the coil). As the coil rotates from the 0PP position, coil sides AAP⁄P and BBP ⁄P cut across flux lines, hence, voltagebuilds, reaching a peak when flux is cut at the maximum rate in the 90P °Pposition as in (b). Note the polarity of the voltage and the direction of current. As the coil rotates further, voltage decrease, reaching zero at the 180P°Pposition when the coil sides again move parallel to the field as in (c).At this point, the coil has gone through a half-revolution.During the second half-revolution, coil sides cut flux in directions opposite to that which they did in the first half revolution, hence, the polarity of the induced voltage reverses. As indicated in (d), voltage reaches a peak at the 270P °P point, and, since the polarity of the voltage has changed, so has the direction of current. When the coil reaches the 380P °P position, voltage is again zero and the cycle starts over. Fig. (1.1) shows one cycle of the resulting waveform. Since the coil rotates continuously, the voltage produced will be a repetitive, periodic waveform as you saw in fig. (1.1).E.m.f. generated in one side of loop= Blv · sinφ , and total e.m.f. generated in loop=2 × Blv · sinφ (volts), where(B): flux density in (teslas), (l): length in (meters), (v): the conductor

velocity, is measured in meters per second.



(a) 0° Position: Coil sides move parallel to flux lines. Since no flux is being cut, induced voltage is zero.

(b) 90° Position: Coil end *A* is positive with respect to *B*. Current direction is out of slip ring *A*.

(c) 180° Position: Coil again cutting no flux. Induced voltage is zero.

(d) 270° Position: Voltage polarity has reversed, therefore, current direction reverses.

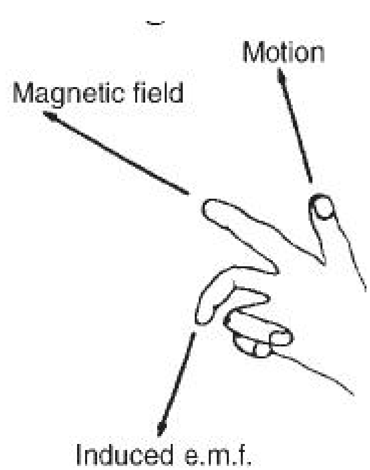
Coil voltage versus angular position.

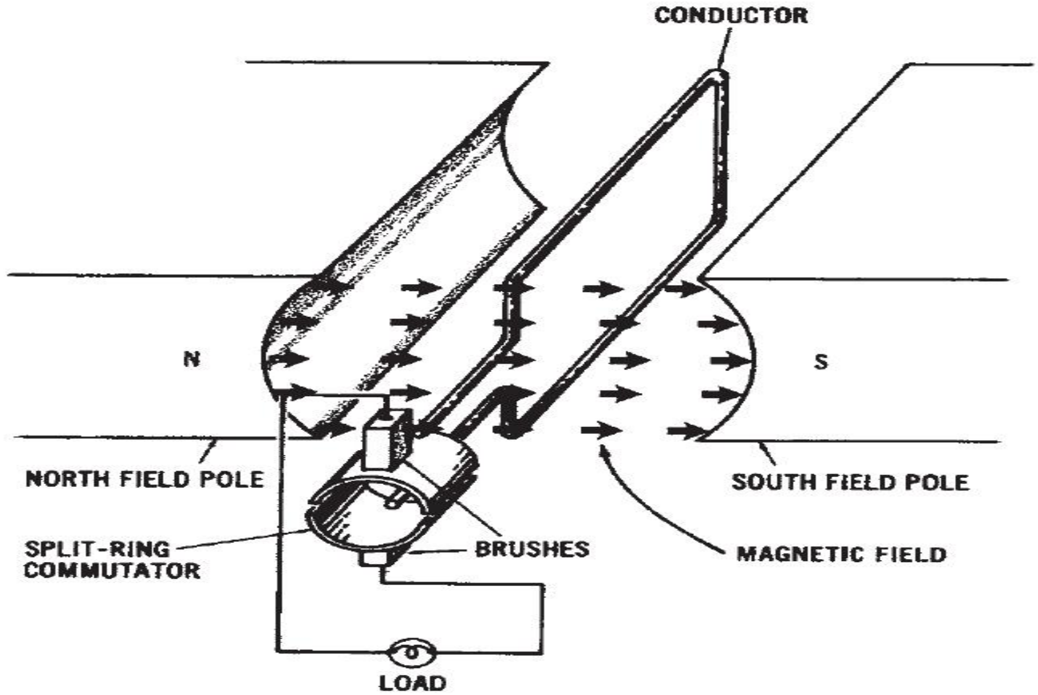
FIG 3.4:LOOP GENERATOR

1.8 Construction of DC Generators

The parts of a simple DC generator are shown in fig.(1.3). The principle of operation of a DC generator is similar to that of the AC generator, which was discussed previously. A rotating armature coil passes through a magnetic field that develops between the north and south polarities of permanent magnets or electromagnets. As the coil rotates, electromagnetic induction causes current to be induced into the coil. The current produced is an alternating current. However, it is possible to convert the alternating current that is induced into the armature into a form of direct current. This conversion of AC into DC is accomplished through the use of a commutator. The conductors of the armature of a DC generator are connected to commutator segments. The commutator shown in fig. (1.3) has two segments, which are insulated from one an other and from the shaft of the machine on which it rotates. An end of each armature conductor is connected to each commutator segment. The purpose of the commutator is to reverse the armature coil connection to the external load circuit at the same time that the current induced in the armature coil reverses. This causes DC at the correct polarity to be applied to the load at all times.

Figure





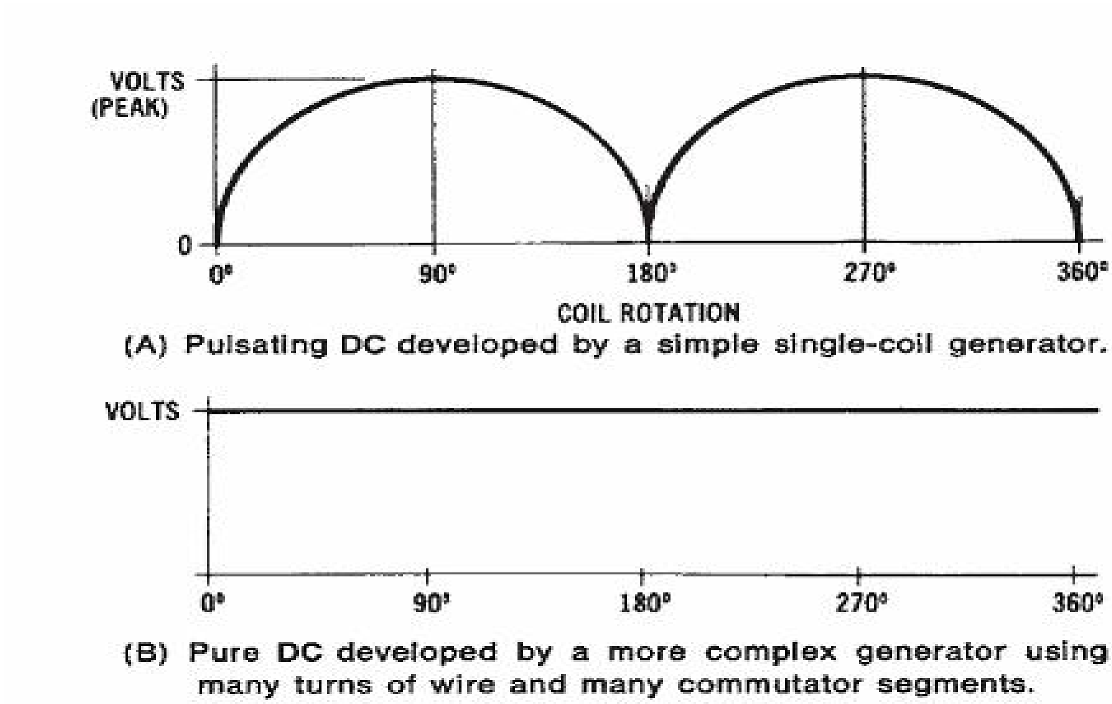


FIG 3.5: DC GENERATOR

U1.8.1Armature Windings

Armature windings can be divided into two groups, depending on how the wires are joined to the commutator. These are called (lap windings) and (wave windings). These windings will be examined individually below, and their advantage and disadvantage will be discussed.

U1.8.2The Lap Winding;

The simplest type of winding construction used in modern DC machines is the simplex lap winding. A simplex lap winding is a rotor (armature) winding consisting of coils containing one or more turns of wire with the two end of each coil coming out at adjacent commutator segments fig. (1.5). The number of current paths in a machine is :

a = mp lap winging, Where:

a : number of current path in the rotor.

m: plex of the windings (1,2,3,etc….)

p : number of poles on the machines.

Lap wound generators produce high current, low voltage output.

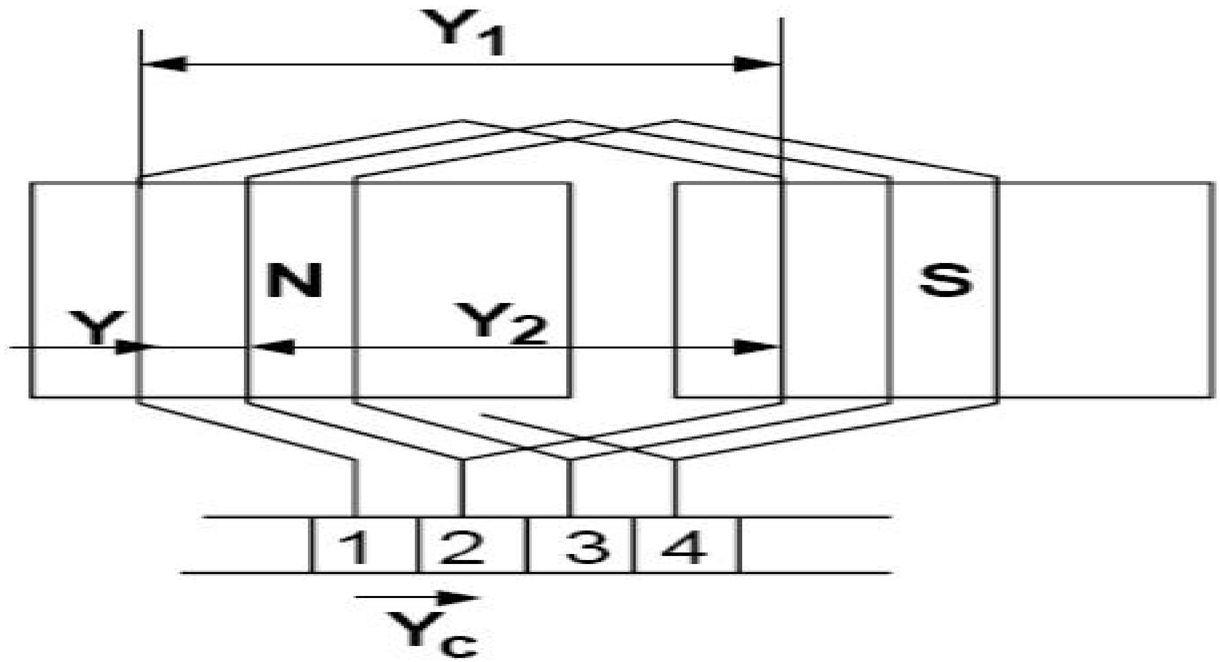


FIG 3.6:LAP WINDING

1.8.3 The Wave Winding

The wave winding is an alternative way to connect the rotor(armature) coils to the commutator segments. Fig. (1.6) shows a simple wave winding. In this simplex wave winding, every other rotor coil connects back to a commutator segment adjacent to the beginning of the first coil. Therefore, there are two coils in series between the adjacent

commutator segments. Furthermore, since each pair of coils between adjacent segments has a side under each pole face, all output voltage are the sum of the effects of every pole, and there can be no voltage imbalances. wave windings, generators produce higher-voltage, low current outputs, since the number of coils in series between commutator

segments permits a high voltage to be built up more easy than with

a = 2m multiplex wave

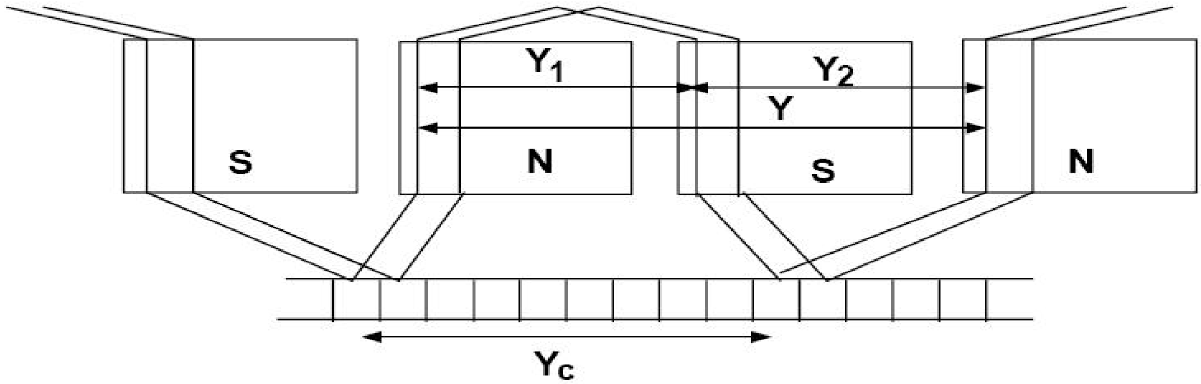


Fig 3.6 :Wave wound DC machine.

1.5 Electromotive Force (e.m.f) Equation

The induced voltage in any given machine depends on three factors:

1. The flux φ in the machine

2. The speed ω of the machine's rotor.

3. A constant depending on the construction of the machine.

The voltage out of the armature of a real machine is equal to the number of conductors per current path time the voltage on each conductor. The voltage in any single conductor under the pole faces was previously shown to be.e Blv in =Where B , the flux density, is measured in teslas, l , the length of conductor in the magnetic field, is measured in meters, and v , the conductor velocity, is measured in meters per second.The voltage out of the armature of a real machine is thus E ZBlv A =Where (z) is the total number of conductors and (a) is the number of current paths. The velocity of each conductor in rotor can be expressed v = rω , where r is the radius of the rotor, ω , angular velocity in radiansper second, soThis voltage can be re-expressed in a more convenient form by noting that the flux of a pole is equal to the flux density under the pole times the pole's area: p φ= BA The rotor of the machine is shaped like a cylinder, so its area is

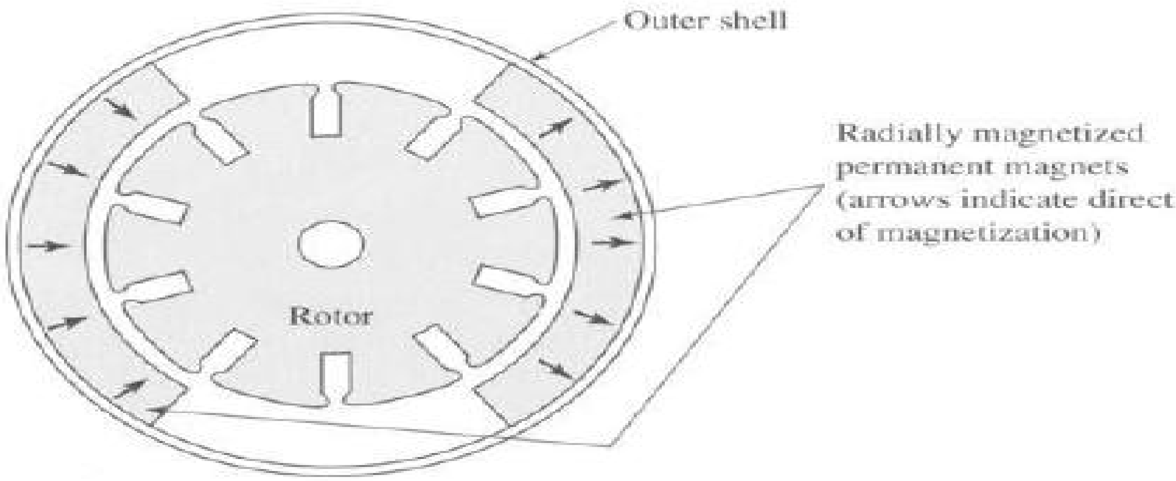
$A = 2\pi rl$

1.9 Types of D.C Generators:

D.C Generators are classified according to the way in which a magnetic field is developed in the stator of the machine. Thus, there are three basic classification DC generators (1) permanent-magnet field (2) separately-excited field and (3) self-excited field.

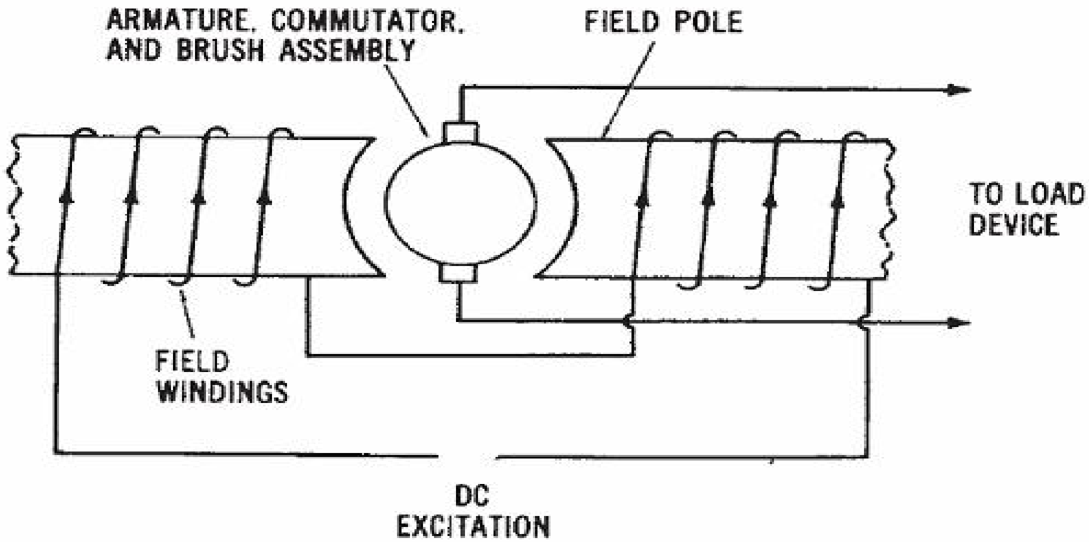
1) permanent-magnet field

Permanent-magnet DC machines are widely found in a wide variety of low-power applications. The field winding is replaced by a permanent magnet, resulting in simpler construction. Chief among these is that they do not require external excitation and its associated power dissipation to create magnetic fields in the machine the space required for the permanent magnets may be less than that required for the field winding, and thus machine may be smaller, and in some cases cheaper, than their externally excited counter parts. Notice that the rotor of this machines consists of a conventional DC armature with commutator segments and brushes.

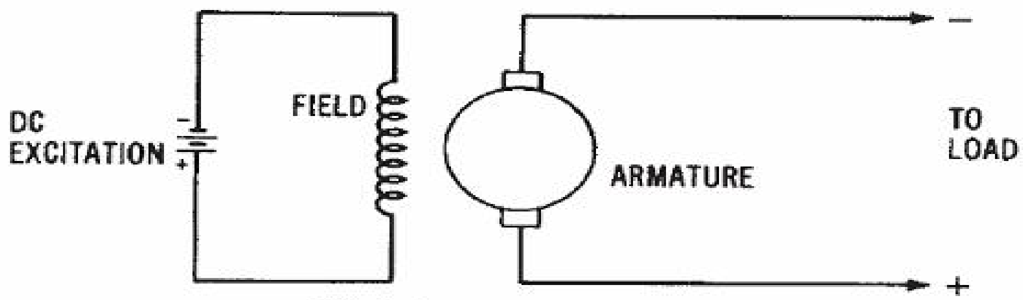


2) Separately-excited field

Separately-excited generators are those whose field magnets are energized from an independent external source of DC current. It is shown diagrammatically in fig (1.8).



(A) Pictorial diagram.



(B) Schematic diagram.

3) Self-excited field

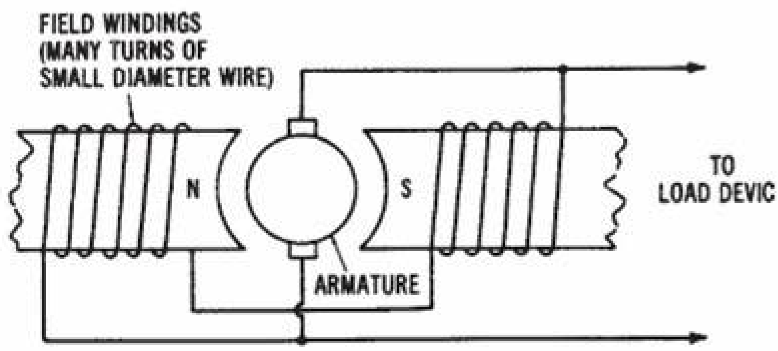
Self-excited generators are those whose field magnets are energized by the current produced by the generators themselves. Due to residual magnetism, there is always present some flux in poles. When the armature is rotated, some e.m.f and hence some induced current is produced which is partly or fully passed through the field coils thereby

strengthening the residual pole flux. There are three types of self-excited generators named according to the manner in which their field coils (or windings) are connected to

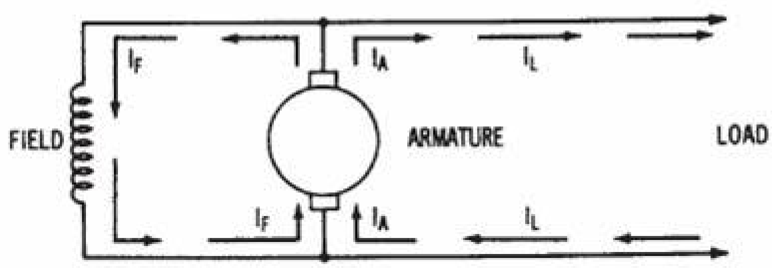
armature.

(a) Shunt -Wound

The field windings are connected across or in parallel with the armature conductors and have the full voltage of the generator applied across them fig. (1.9).



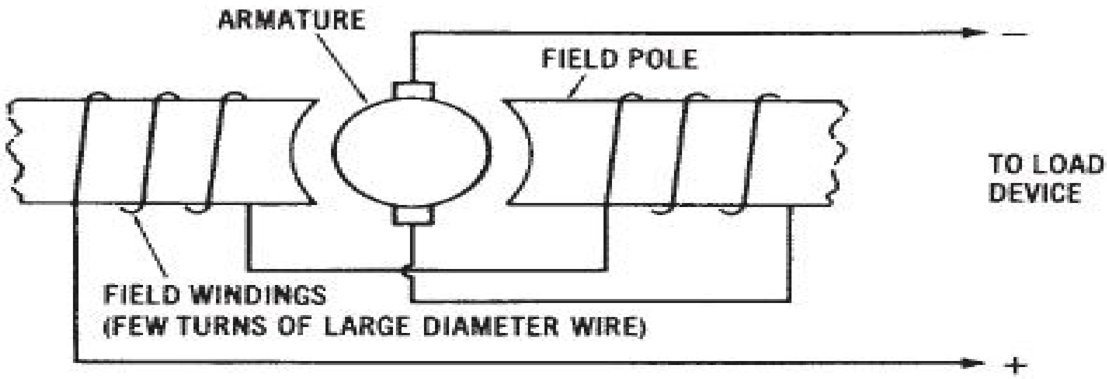
(A) Pictorial diagram.



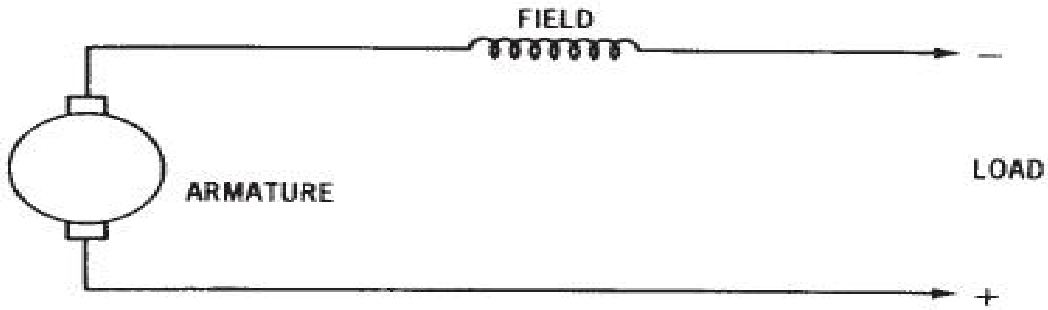
(B) Schematic diagram.

(b) Series -Wound

In this case, the field windings are joined in series with the armature conductors fig. (1.10). As they carry full load current, they consist of relatively few turn of thick wire or strips. Such generators are rarely used except for special purposes.



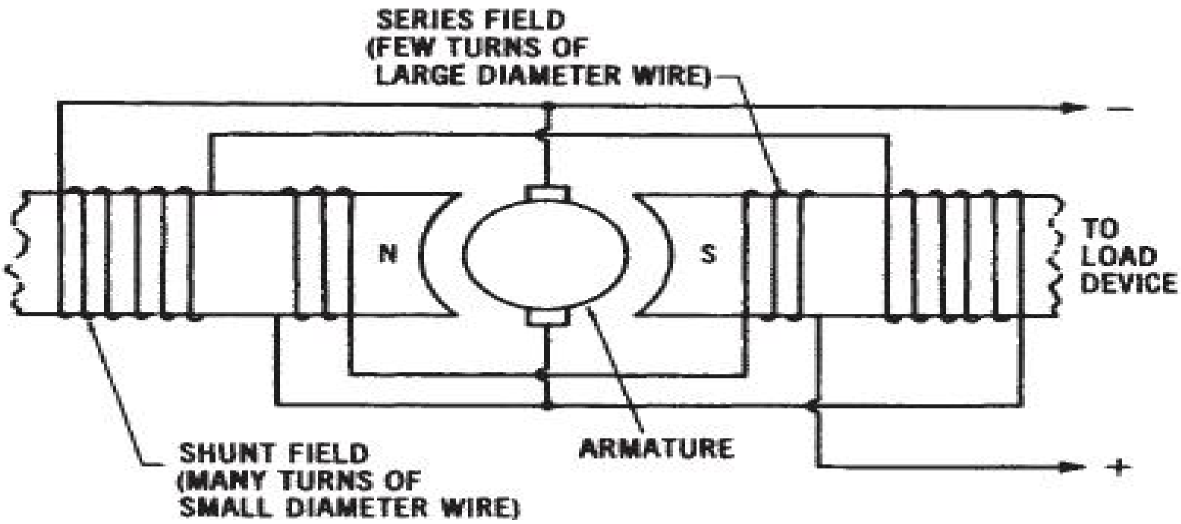
(A) Pictorial diagram.



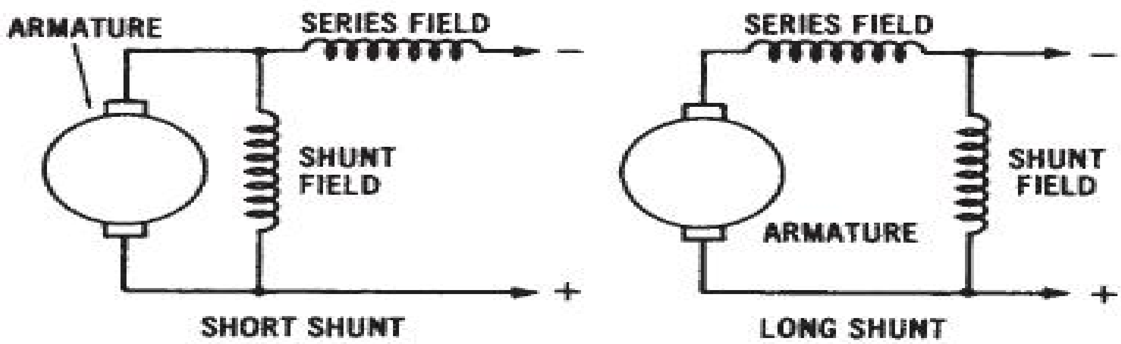
(B) Schematic diagram.

(c) Compound –Wound

The compound-wound D.C generator has two sets of field windings. One set is made of low-resistance windings and is connected in series with the armature circuit. The other set is made of high-resistance wire and is connected in parallel with the armature circuit. A compound wound D.C generator is illustrated in figure (1.11), can be either short-shunt or long-shunt. In a compound generator, the shunt field is stronger than the series field. When series field aids the shunt field, generator is said to be cumulatively-compounded. On the other hand if series field opposes the shunt field, the generator is said to be differentially compounded. Various types of DC generators have been



(A) Pictorial diagram.



(B) Schematic diagram.

1.9.1 HIGH POWER LED:

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown in figures 3.15 and 3.16 respectively.

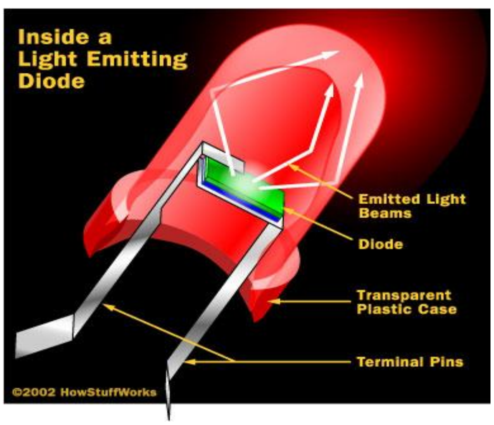


Fig 3.8: Inside a LED

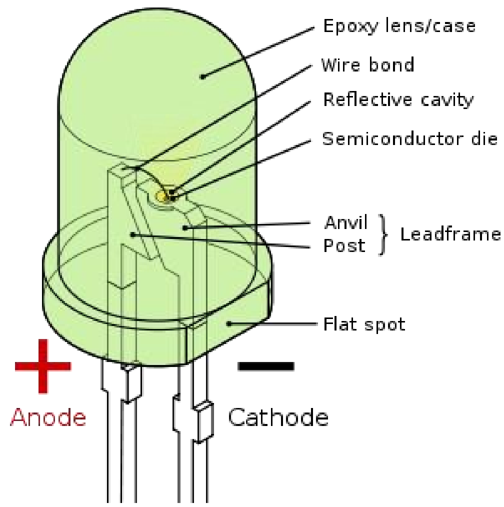


Fig 3.9: Parts of a LED

Working:

The structure of the LED light is completely different than that of the light bulb. Amazingly, the LED has a simple and strong structure. The light-emitting semiconductor material is what determines the LED's color. The LED is based on the semiconductor diode.

When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 mm^2), and integrated optical components are used to shape its radiation pattern and assist in reflection. LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability. However, they are relatively expensive and require more precise current and heat management than traditional light sources. Current LED products for general lighting are more expensive to buy than fluorescent lamp sources of comparable output.They also enjoy use in applications as diverse as replacements for traditional light sources in automotive lighting (particularly indicators) and in traffic signals. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in advanced communications technology. The electrical symbol and polarities of led are shown in fig: 3.17.

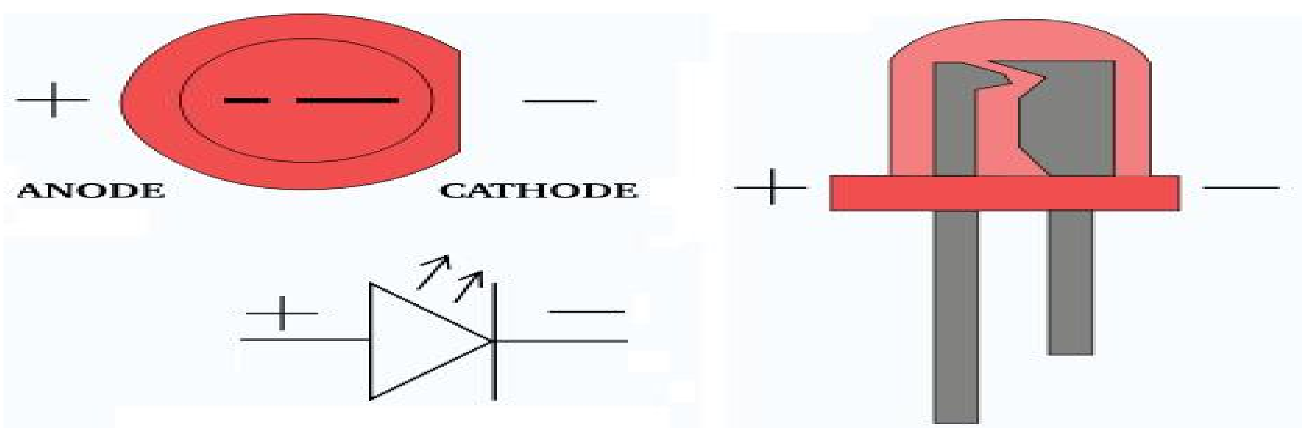


Fig 3.10: Electrical Symbol & Polarities of LED

LED lights have a variety of advantages over other light sources:

- High-levels of brightness and intensity
- High-efficiency

- Low-voltage and current requirements
- Low radiated heat
- High reliability (resistant to shock and vibration)
- No UV Rays
- Long source life
- Can be easily controlled and programmed

Applications of LED fall into three major categories:

- Visual signal application where the light goes more or less directly from the LED to the human eye, to convey a message or meaning.
- Illumination where LED light is reflected from object to give visual response of these objects.
- Generate light for measuring and interacting with processes that do not involve the human visual system.

1.9.2 REGULATED POWER SUPPLY:

Introduction:

Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

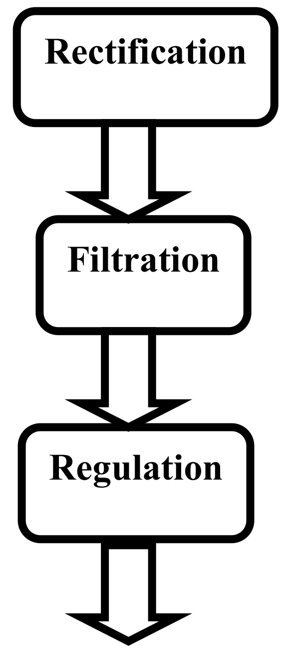
A power supply may include a power distribution system as well as primary or secondary sources of energy such as

- Conversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household electronics.

- Batteries.
- Chemical fuel cells and other forms of energy storage systems.
- Solar power.
- Generators or alternators.

The components mainly used are

- BRIDGE RECTIFIER(DIODES)
- CAPACITOR
- VOLTAGE REGULATOR(IC 7805)
- RESISTOR
- LED(LIGHT EMITTING DIODE)



POWER SUPPLY DESIGN:

The detailed explanation of each and every block and component mentioned above is as follows:

1. Rectification:

The process of converting an alternating current to a pulsating direct current is called as rectification. For rectification purpose we use rectifiers.

Rectifiers:

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid-state diodes, vacuum tube diodes, mercury arc valves, and other components.

A device that it can perform the opposite function (converting DC to AC) is known as an inverter.

When only one diode is used to rectify AC (by blocking the negative or positive portion of the waveform), the difference between the term diode and the term rectifier is merely one of usage, i.e., the term rectifier describes a diode that is being used to convert AC to DC. Almost all rectifiers comprise a number of diodes in a specific arrangement for more efficiently converting AC to DC than is possible with only one diode. Before the development of silicon semiconductor rectifiers, vacuum tube diodes and copper (I) oxide or selenium rectifier stacks were used.

Bridge full wave rectifier:

The Bridge rectifier circuit is shown in fig:3.8, which converts an ac voltage to dc voltage using both half cycles of the input ac voltage. The Bridge rectifier circuit is shown in the figure. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

For the positive half cycle of the input ac voltage, diodes D1 and D3 conduct, whereas diodes D2 and D4 remain in the OFF state. The conducting diodes will be in series with the load resistance R_L and hence the load current flows through $R_{L.}$

For the negative half cycle of the input ac voltage, diodes D2 and D4 conduct whereas, D1 and D3 remain OFF. The conducting diodes D2 and D4 will be in series with the load resistance R_L and hence the current flows through R_L in the same direction as in the previous half cycle. Thus a bi-directional wave is converted into a unidirectional wave.

Input Output

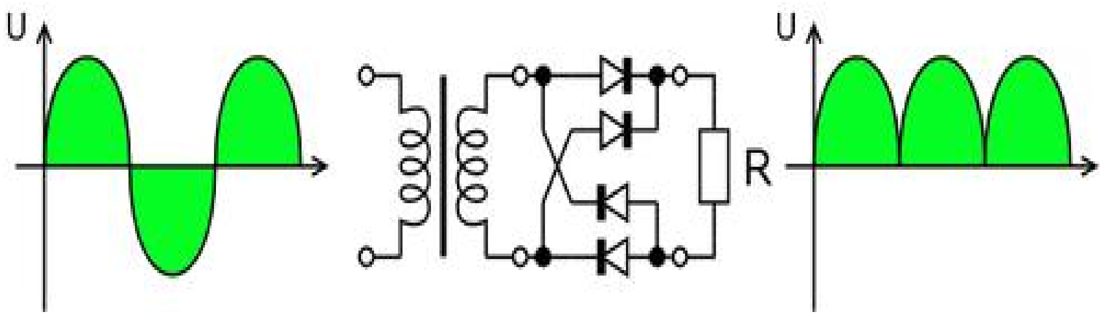


Fig 3.11: Bridge rectifier: a full-wave rectifier using 4 diodes

DB107:

Now -a -days Bridge rectifier is available in IC with a number of DB107. In our project we are using an IC in place of bridge rectifier. The picture of DB 107 is shown below

Features:

- Good for automation insertion
- Surge overload rating - 30 amperes peak
- Ideal for printed circuit board
- Reliable low cost construction utilizing molded
- Glass passivated device
- Polarity symbols molded on body
- Mounting position: Any
- Weight: 1.0 gram

Fig 3.12: DB107

2.Filtration:

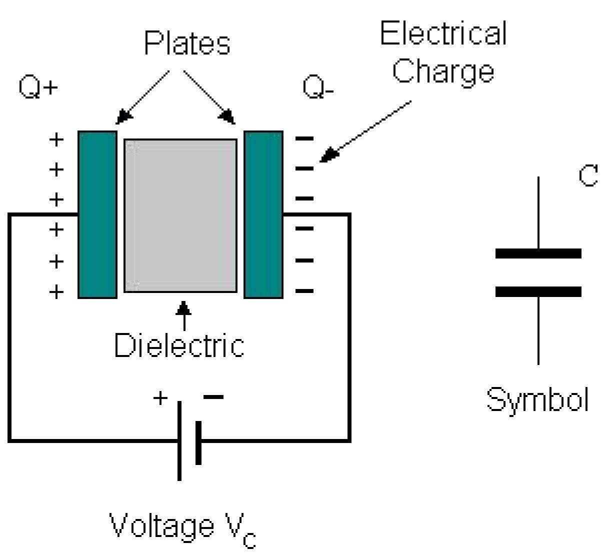
The process of converting a pulsating direct current to a pure direct current using filters is called as filtration.

3.Filters:

Electronic filters are electronic circuits, which perform signal-processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones.

Introduction to Capacitors:

The Capacitor or sometimes referred to as a Condenser is a passive device, and one which stores energy in the form of an electrostatic field which produces a potential (static voltage) across its plates. In its basic form a capacitor consists of two parallel conductive plates that are not connected but are electrically separated either by air or by an insulating material called the Dielectric. When a voltage is applied to these plates, a current flows charging up the plates with electrons giving one plate a positive charge and the other plate an equal and opposite negative charge. This flow of electrons to the plates is known as the Charging Current and continues to flow until the voltage across the plates (and hence the capacitor) is equal to the applied voltage Vcc. At this point the capacitor is said to be fully charged and this is illustrated below. The construction of capacitor and an electrolytic capacitor are shown in figures 3.10 and 3.11 respectively.



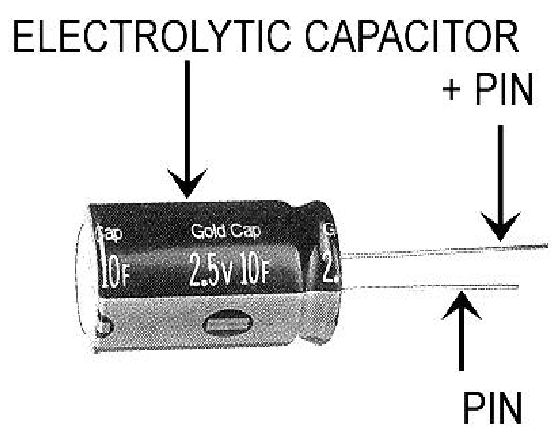


Fig 3.13:Construction Of a Capacitor ***Fig 3.14:Electrolytic Capaticor***

Units of Capacitance:

Microfarad (μF) 1μF = 1/1,000,000 = 0.000001 = 10^{-6} F

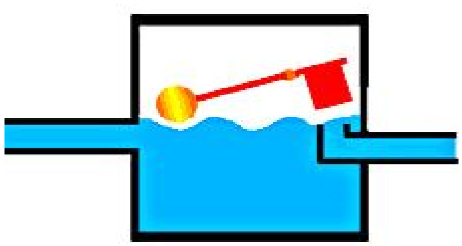
Nanofarad (nF) 1nF = 1/1,000,000,000 = 0.000000001 = 10^{-9} F

Pico farad (pF) 1pF = 1/1,000,000,000,000 = 0.000000000001 = 10^{-12} F

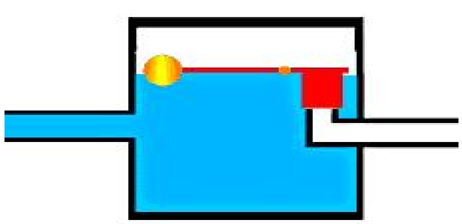
Operation of Capacitor:

Think of water flowing through a pipe. If we imagine a capacitor as being a storage tank with an inlet and an outlet pipe, it is possible to show approximately how an electronic capacitor works.

First, let's consider the case of a "coupling capacitor" where the capacitor is used to connect a signal from one part of a circuit to another but without allowing any direct current to flow.



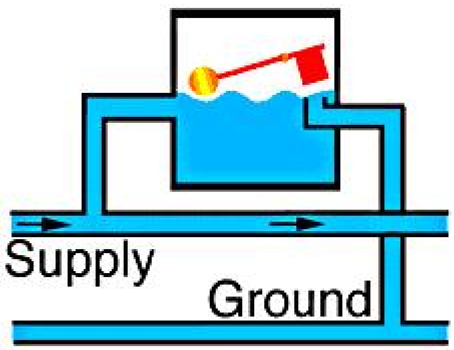
If the current flow is alternating between zero and a maximum, our "storage tank" capacitor will allow the current waves to pass through.



However, if there is a steady current, only the initial short burst will flow until the "floating ball valve" closes and stops further flow.

So a coupling capacitor allows "alternating current" to pass through because the ball valve doesn't get a chance to close as the waves go up and down. However, a steady current quickly fills the tank so that all flow stops.

A capacitor will pass alternating current but (apart from an initial surge) it will not pass d.c.



Where a capacitor is used to decouple a circuit, the effect is to "smooth out ripples". Any ripples, waves or pulses of current are passed to ground while d.c. Flows smoothly.

3.Regulation:

The process of converting a varying voltage to a constant regulated voltage is called as regulation. For the process of regulation we use voltage regulators.

Voltage Regulator:

A voltage regulator (also called a 'regulator') with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It converts a varying input voltage into a constant 'regulated' output voltage. Voltage Regulators are available in a variety of outputs like 5V, 6V, 9V, 12V and 15V. The LM78XX series of voltage regulators are designed for positive input. For applications requiring negative input, the LM79XX series is used. Using a pair of 'voltage-divider' resistors can increase the output voltage of a regulator circuit.

It is not possible to obtain a voltage lower than the stated rating. You cannot use a 12V regulator to make a 5V power supply. Voltage regulators are very robust. These can withstand over-current draw due to short circuits and also over-heating. In both cases, the regulator will cut off before any damage occurs. The only way to destroy a regulator is to apply reverse voltage to its input. Reverse polarity destroys the regulator almost instantly. Fig: 3.12 shows voltage regulator.

Fig 3.15: Voltage Regulator

Resistors:

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current passing through it in accordance with Ohm's law:

$$V = IR$$

Resistors are elements of electrical networks and electronic circuits and are ubiquitous in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).

The primary characteristics of a resistor are the resistance, the tolerance, maximum working voltage and the power rating. Other characteristics include temperature coefficient, noise, and inductance. Less well-known is critical resistance, the value below which power dissipation limits the maximum permitted current flow, and above which the limit is applied voltage. Critical resistance is determined by the design, materials and dimensions of the resistor.

Resistors can be made to control the flow of current, to work as Voltage dividers, to dissipate power and it can shape electrical waves when used in combination of other components. Basic unit is ohms.

Theory of operation:

Ohm's law:

The behavior of an ideal resistor is dictated by the relationship specified in Ohm's law:

$$V = IR$$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I) through it where the constant of proportionality is the resistance (R).

Power dissipation:

The power dissipated by a resistor (or the equivalent resistance of a resistor network) is calculated using the following:

$$P = I^2 R = IV = \frac{V^2}{R}$$

Fig 3.16: Resistor

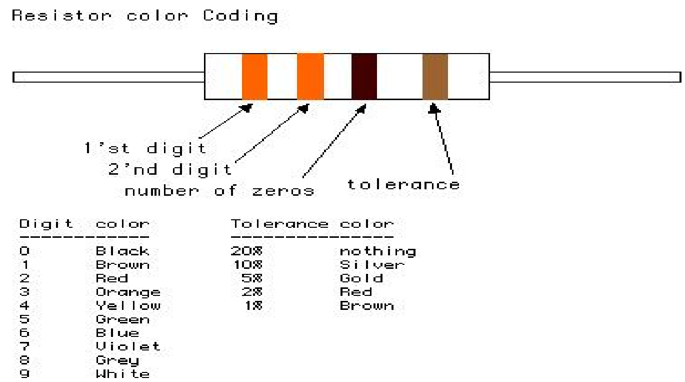


Fig 3.17: Color Bands In Resistor

1.9.3 RECHARGEABLE BATTERY:

12V Rechargeable Battery

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging frombutton cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead–acid,nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer).

Rechargeable batteries have lower total cost of use and environmental impact than disposable batteries. Some rechargeable battery types are available in the same sizes as disposable types. Rechargeable batteries have higher initial cost but can be recharged very cheaply and used many times.

Usage and applications

Rechargeable batteries are used for automobile starters, portable consumer devices, light vehicles (such as motorized wheelchairs, golf carts, electric bicycles, and electric forklifts), tools, and uninterruptible power supplies. Emerging applications in hybrid electric vehicles and electric vehicles are driving the technology to reduce cost and weight and increase lifetime.

Traditional rechargeable batteries have to be charged before their first use; newer low self-discharge NiMH batteries hold their charge for many months, and are typically charged at the factory to about 70% of their rated capacity before shipping.

Grid energy storage applications use rechargeable batteries for load leveling, where they store electric energy for use during peak load periods, and for renewable energy uses, such as storing power generated from photovoltaic arrays during the day to be used at night. By charging batteries during periods of low demand and returning energy to the grid during periods of high electrical demand, load-leveling helps eliminate the need for expensive peaking power plants and helps amortizethe cost of generators over more hours of operation.

The US National Electrical Manufacturers Association has estimated that U.S. demands for rechargeable batteries is growing twice as fast as demand for non rechargeable.

Charging and discharging

Further information: Battery charger

During charging, the positive active material is oxidized, producing electrons, and the negative material is reduced, consuming electrons. These electrons constitute the current flow in the external circuit. The electrolyte may serve as a simple buffer for internal ion flow between the electrodes, as in lithium-ion and nickel-cadmium cells, or it may be an active participant in the electrochemical reaction, as in lead–acid cells.

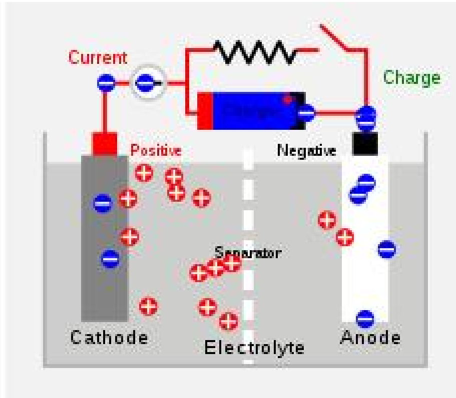


Diagram of the charging of a secondary cell battery.

Battery charger

A solar-powered charger for rechargeable AA batteries

The energy used to charge rechargeable batteries usually comes from a battery chargerusing AC mains electricity, although some are equipped to use a vehicle's 12-volt DC power outlet. Regardless, to store energy in a secondary cell, it has to be connected to a DC voltage source. The negative terminal of the cell has to be connected to the negative terminal of the voltage source and the positive terminal of the voltage source with the positive terminal of the battery. Further, the voltage output of the source must be higher than that of the battery, but not much higher: the greater the difference between the power source and the battery's voltage capacity, the faster the charging process, but also the greater the risk of overcharging and damaging the battery.

Chargers take from a few minutes to several hours to charge a battery. Slow "dumb" chargers without voltage- or temperature-sensing capabilities will charge at a low rate, typically taking 14 hours or more to reach a full charge. Rapid chargers can typically charge cells in two to five hours, depending on the model, with the fastest taking as little as fifteen minutes. Fast chargers must have multiple ways of detecting when a cell reaches full charge (change in terminal voltage, temperature, etc.) to stop charging before harmful overcharging or overheating occurs. The fastest chargers often incorporate cooling fans to keep the cells from overheating.

Battery charging and discharging rates are often discussed by referencing a "C" rate of current. The C rate is that which would theoretically fully charge or discharge the battery in one hour. For example, trickle charging might be performed at C/20, while typical charging and discharging may occur at C/2. (In practice, charging and discharging batteries incurs losses, so the "C" rate is more of an approximation.) In general, the higher the current relative to battery capacity, the worse the effective storage capacity and overall life of the battery will be. Flow batteries, used for specialized applications, are recharged by replacing the electrolyte liquid.

Battery manufacturers' technical notes often refer to VPC; this is volts per cell, and refers to the individual secondary cells that make up the battery. (This is typically in reference to 12-volt lead-acid batteries.) For example, to charge a 12 V battery (containing 6 cells of 2 V each) at 2.3 VPC requires a voltage of 13.8 V across the battery's terminals.

Non-rechargeable alkaline and zinc–carbon cells output 1.5V when new, but this voltage drops with use. Most NiMH AA and AAA cells are rated at 1.2 V, but have a flatter discharge curve than alkalines and can usually be used in equipment designed to use alkaline batteries.

1.9.4 Reverse charging

Subjecting a discharged cell to a current in the direction which tends to discharge it further, rather than charge it, is called reverse charging; this damages cells. Reverse charging can occur under a number of circumstances, the two most common being:

- When a battery or cell is connected to a charging circuit the wrong way around.
- When a battery made of several cells connected in series is deeply discharged.

When one cell completely discharges ahead of the rest, the remaining cells will force the current through the discharged cell. Instead of supplying a forward voltage to the load, the discharged cell becomes part of the load and presents a reverse voltage to the rest of the circuit. This is known as "cell reversal", and can happen even to a weak cell that is not fully discharged. If the battery drain current is high enough, the weak cell's internal resistance can create a reverse voltage that is greater than the cell's remaining internal forward voltage. This results in the reversal of the weak cell's polarity while the current is flowing through the cells. "Pushing" current through a discharged cell causes undesirable and irreversible chemical reactions to occur, resulting in permanent damage to the cell. The higher the required discharge rate of the battery, the better matched the cells should be, both in kind of cell and state of charge, in order to reduce the chances of one cell completely discharging before the others. Also, many battery-operated devices have a low-voltage cutoff that prevents deep discharges from occurring that might cause cell reversal.

In critical applications using Ni-Cad batteries, such as in aircraft, each cell is individually discharged by connecting a load clip across the terminals of each cell, thereby avoiding cell reversal, then charging the cells in series.

1.9.5 Depth of discharge

Main article: Depth of discharge

Depth of discharge (DOD) is normally stated as a percentage of the nominal ampere-hour capacity; 0% DOD means no discharge. Seeing as the usable capacity of a battery system depends on the rate of discharge and the allowable voltage at the end of discharge, the depth of discharge must be qualified to show the way it is to be measured. Due to variations during manufacture and aging, the DOD for complete discharge can change over time or number of charge cycles. Generally a rechargeable battery system will tolerate more charge/discharge cycles if the DOD is lower on each cycle.[5]

Table of rechargeable battery types

Type	Voltage[a]	Energy density[b]			Power[c]	Effi.[d]	E/$[e]	Disch.[f]	Cycles[g]	Life[h]
	(V)	(MJ/kg)	(Wh/kg)	(Wh/L)	(W/kg)	(%)	(Wh/$)	(%/month)	(#)	(years)

Lead–acid	2.1	0.11-0.14	30-40	60-75	180	70% - 92%	5-8	3%-4%	500-800	5-8 (automotive battery), 20 (stationary)
Alkaline	1.5	0.31	85	250	50	--	7.7	<0.3	100-1000	<5
Nickel–iron	1.2	0.18	50		100	65%	5-7.3[6]	20%-40%		50+
Nickel–cadmium	1.2	0.14-0.22	40-60	50-150	150	70% - 90%	1.25-2.5[6]	20%	1500	
Nickel–hydrogen	1.5	0.27	75	60	220	85%			20,000+	15+ (satellite application with frequent charge-discharge cycles)

Nickel–metal hydride	1.2	0.11-0.29	30-80	140-300	250-1000	66%	2.75	30%	500-1000	
Nickel–zinc	1.7	0.22	60	170	900		2-3.3		100-500	
Lithium-air (organic)[7]	2.7	7.2	2000	2000	400				~100	
Lithium-ion	3.6	0.58	150-250	250-360	1800	99%+[citation needed]	2.8-5[8]	5%-10%	1200-10000	2-6
Lithium-ion polymer	3.7	0.47-0.72	130-200	300	3000+	99.8%[citation needed]	2.8-5.0	5%	500~1000	2-3
Lithium iron phosphate	3.25	0.32-0.4	80-120	170[citation needed]	1400	93.5%	0.7-3.0		2000+[9]	>10
Lithium	2.0	0.94-1.44[1	400[12]	350					~100	

sulfur[10]		1]								
Lithium–titanate	2.3	0.32	90		4000+	87-95%r	0.5-1.0[citation needed]		9000+	20+
Sodium-ion[13]	1.7			30		85%	3.3		5000+	Still testing
Thin film lithium	?			350	959	?	?p[14]		40000	
Zinc bromide		0.27-0.31	75-85							
Vanadium redox	1.15-1.55	0.09-0.13	25-35[15]			80%[16]		20%[16]	14,000[17]	10(stationary)[16]
Sodium-sulfur		0.54	150			89%-92%				
Molten salt	2.58	0.25-1.04	70-290[18]	160[6]	150-220		4.54[19]		3000+	<=20
Silver-oxide	1.86	0.47	130	240						

1.9.6 Common rechargeable battery types:

Nickel–cadmium battery (NiCd)

Created by Waldemar Jungner of Sweden in 1899, it used nickel oxide hydroxide and metallic cadmium as electrodes. Cadmium is a toxic element, and was banned for most uses by the European Union in 2004. Nickel–cadmium batteries have been almost completely superseded by nickel–metal hydride (NiMH) batteries.

Nickel–metal hydride battery (NiMH)

First commercial types were available in 1989.[20] These are now a common consumer and industrial type. The battery has a hydrogen-absorbing alloy for the negative electrode instead of cadmium.

Lithium-ion battery

The technology behind the lithium-ion battery has not yet fully reached maturity. However, the batteries are the type of choice in many consumer electronics and have one of the best energy-to-mass ratios and a very slow loss of charge when not in use.

Lithium-ion polymer battery

These batteries are light in weight and can be made in any shape desired.

Less common types:

Lithium sulfur battery:

A new battery chemistry developed by Sion Power since 1994.[21] Claims superior energy to weight than current lithium technologies on the market. Also lower material cost may help this product reach the mass market.[22]

Thin film battery (TFB):

An emerging refinement of the lithium ion technology by Excellatron The developers claim a very large increase in recharge cycles, around 40,000 cycles. Higher charge and discharge rates. At least 5C charge rate. Sustained 60C discharge, and 1000Cpeak discharge rate. And also a significant increase in specific energy, and energy density.

Also Infinite Power Solutions makes thin film batteries (TFB) for micro-electronic applications, which are flexible, rechargeable, solid-state lithium batteries.

Smart battery

A smart battery has the voltage monitoring circuit built inside. See also: Smart Battery System

Carbon foam-based lead acid battery

Firefly Energy has developed a carbon foam-based lead acid battery with a reported energy density of 30-40% more than their original 38 W·h/kg, with long life and very high power density.

Potassium-ion battery

This type of rechargeable battery can deliver the best known cycleability, in order of a million cycles, due to the extraordinary electrochemical stability of potassium insertion/extraction materials such as Prussian blue.

Sodium-ion battery

This type is meant for stationary storage and competes with lead–acid batteries. It aims at a very low total cost ownership per kWh of storage. This is achieved by a long and stable lifetime. The number of cycles is above 5000 and the battery does not get damage by deep discharge. The energy density is rather low, somewhat lower than lead–acid.

1.9.7 INVERTER:

INVERTER CIRCUIT EXPLANATION:

However when it comes to mosfets, this necessity becomes completely insignificant. As can be seen in the given diagram, the AMV stage is instantly preceded by the relevant gates of the mosfets, because mosfets have very high input resistance, which means the AMV transistors wouldn't be unnecessarily loaded and therefore the frequency from the AMVwouldn't be distorted due to the integration of the power devices.

The mosfets are alternately switched, which in turn switches the battery voltage/current inside the secondary winding of the transformer.

The output of the transformer gets saturated delivering the expected 220V to the connected loads.

PartsList

R1,R2=27K,

R3,R4,R5,R6=470Ohms,

C1,C2=0.47uF/100Vmetallized

T1,T2=BC547,

T3,T4=any30V,10ampmosfet,N-channel.

Transformer=9-0-9V,8amp

Battery = 12V,10AH

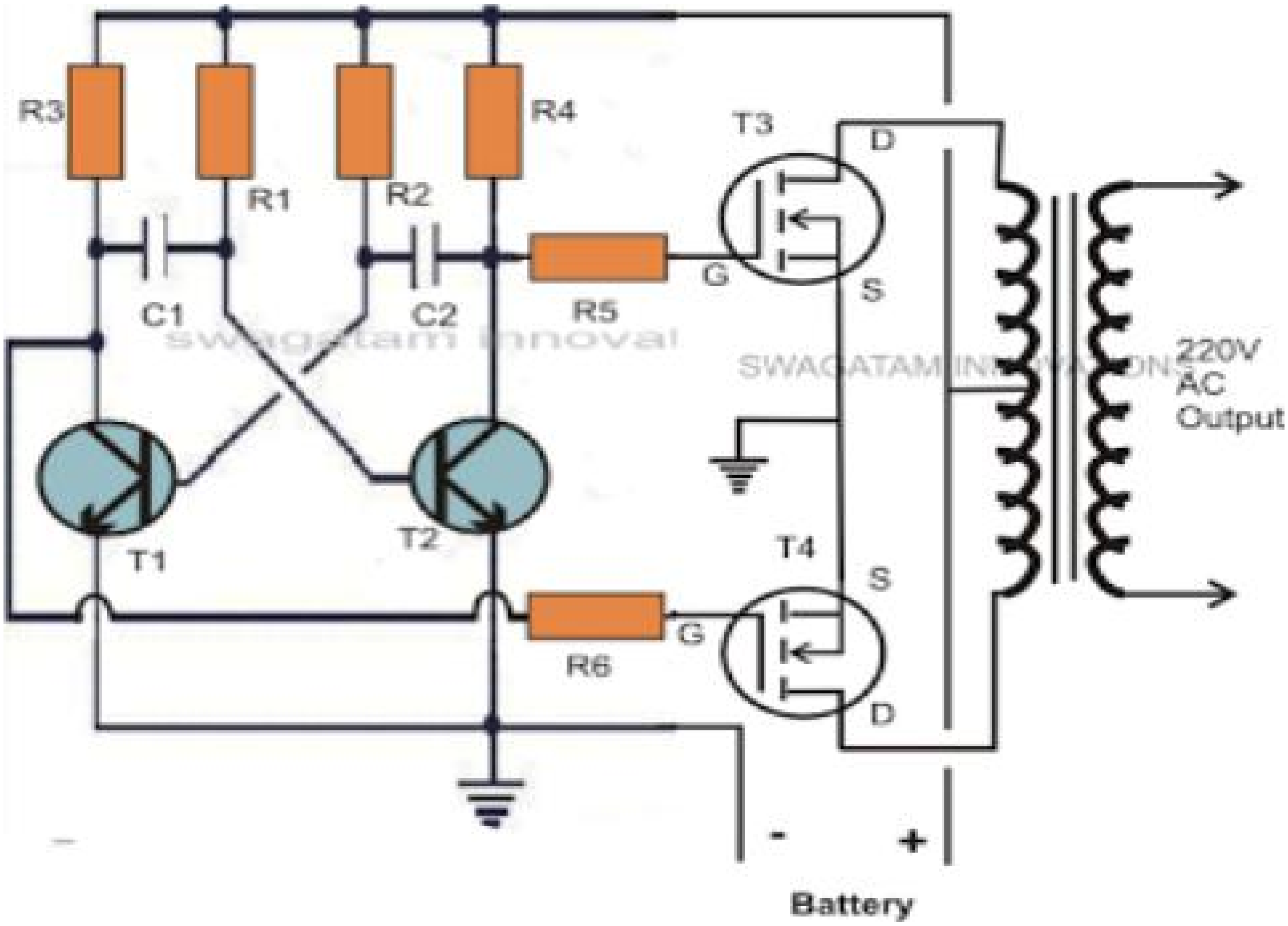


FIG 3.18: INVETOR

1.9.8 MOSFET:

The **metal–oxide–semiconductor field-effect transistor** (**MOSFET**, **MOS-FET**, or **MOS FET**) is a transistor used for amplifying or switching electronic signals. Although the MOSFET is a four-terminal device with source (S), gate (G), drain (D), and body (B) terminals,[1] the body (or substrate) of the MOSFET often is connected to the source terminal, making it a three-terminal device like other field-effect transistors. When two terminals are connected to each other (short-circuited) only three terminals appear in electrical diagrams. The MOSFET is by far the most common transistor in both digital and analog circuits, though the bipolar junction transistor was at one time much more common.

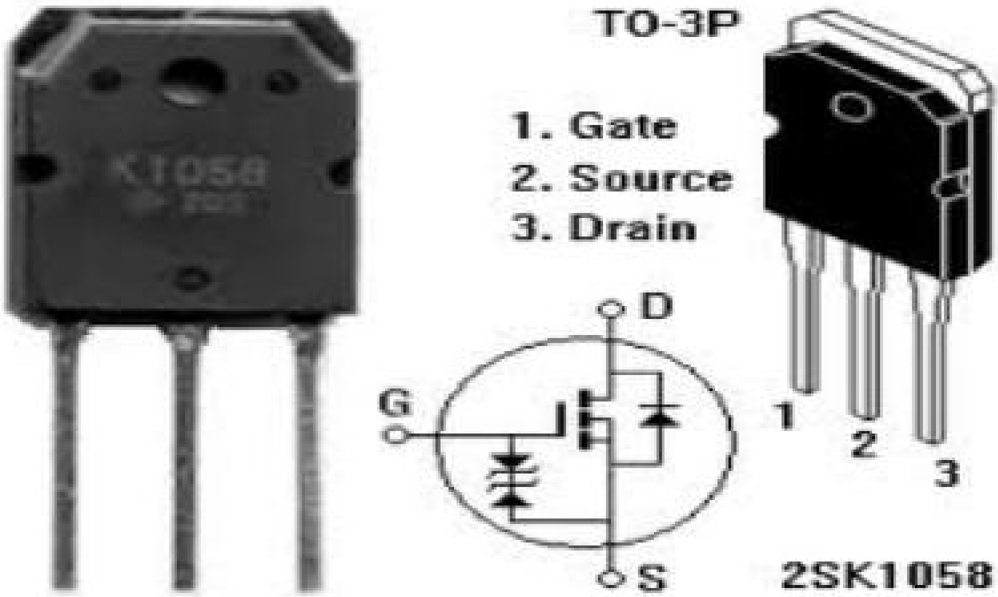


FIG 3.19: MOSFET

In *enhancement mode* MOSFETs, a voltage drop across the oxide induces a conducting channel between the source and drain contacts *via* the field effect. The term "enhancement mode" refers to the increase of conductivity with increase in oxide field that adds carriers to the channel, also referred to as the *inversion layer*. The channel can contain electrons (called an nMOSFET or nMOS), or holes (called a pMOSFET or pMOS), opposite in type to the substrate, so nMOS is made with a p-type substrate, and pMOS with an n-type substrate (see article on semiconductor devices). In the less common *depletion mode* MOSFET, described further later on, the channel consists of carriers in a surface impurity layer of opposite type to the substrate, and conductivity is decreased by application of a field that depletes carriers from this surface layer.[2]

The 'metal' in the name MOSFET is now often a misnomer because the previously metal gate material is now often a layer of polysilicon (polycrystalline silicon). Aluminium had been the gate material until the mid 1970s, when polysilicon became dominant, due to its capability to form self-aligned gates. Metallic gates are regaining popularity, since it is difficult to increase the speed of operation of transistors without metal gates.

Likewise, the 'oxide' in the name can be a misnomer, as different dielectric materials are used with the aim of obtaining strong channels with applied smaller voltages.

An insulated-gate field-effect transistor or **IGFET** is a related term almost synonymous with MOSFET. The term may be more inclusive, since many "MOSFETs" use a gate that is not metal, and a gate insulator that is not oxide. Another synonym is MISFET for metal–insulator–semiconductor FET.

A variety of symbols are used for the MOSFET. The basic design is generally a line for the channel with the source and drain leaving it at right angles and then bending back at right angles into the same direction as the channel. Sometimes three line segments are used for enhancement mode and a solid line for depletion mode. Another line is drawn parallel to the channel for the gate.

The bulk connection, if shown, is shown connected to the back of the channel with an arrow indicating PMOS or NMOS. Arrows always point from P to N, so an NMOS (N-channel in P-well or P-substrate) has the arrow pointing in (from the bulk to the channel). If the bulk is connected to the source (as is generally the case with discrete devices) it is sometimes angled to meet up with the source leaving the transistor. If the bulk is not shown (as is often the case in IC design as they are generally common bulk) an inversion symbol is sometimes used to indicate PMOS, alternatively an arrow on the source may be used in the same way as for bipolar transistors (out for nMOS, in for pMOS).

Comparison of enhancement-mode and depletion-mode MOSFET symbols, along with JFET symbols (drawn with source and drain ordered such that higher voltages appear higher on the page than lower voltages):

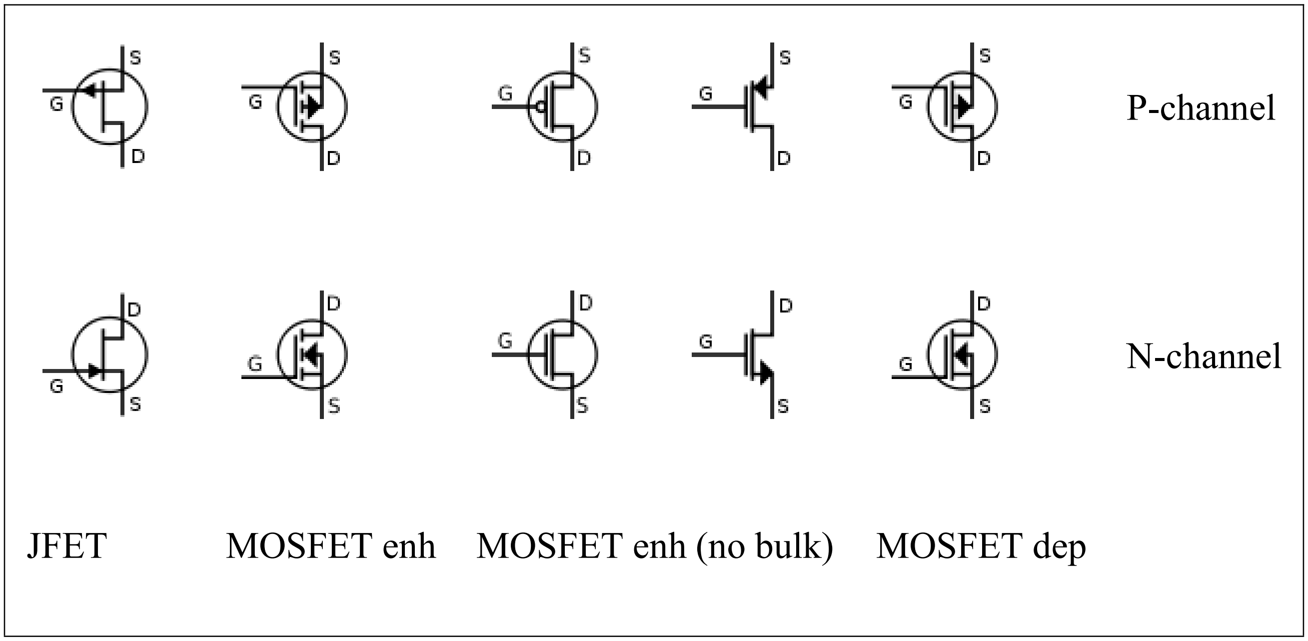
For the symbols in which the bulk, or body, terminal is shown, it is here shown internally connected to the source. This is a typical configuration, but by no means the only important configuration. In general, the MOSFET is a four-terminal device, and in integrated circuits many of the MOSFETs share a body connection, not necessarily connected to the source terminals of all the transistors.

Circuit symbols

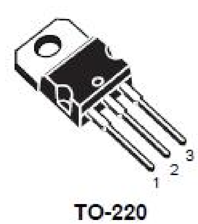
A variety of symbols are used for the MOSFET. The basic design is generally a line for the channel with the source and drain leaving it at right angles and then bending back at right angles into the same direction as the channel. Sometimes three line segments are used for enhancement mode and a solid line for depletion mode. Another line is drawn parallel to the channel for the gate.

The bulk connection, if shown, is shown connected to the back of the channel with an arrow indicating PMOS or NMOS. Arrows always point from P to N, so an NMOS (N-channel in P-well or P-substrate) has the arrow pointing in (from the bulk to the channel). If the bulk is connected to the source (as is generally the case with discrete devices) it is sometimes angled to meet up with the source leaving the transistor. If the bulk is not shown (as is often the case in IC design as they are generally common bulk) an inversion symbol is sometimes used to indicate PMOS, alternatively an arrow on the source may be used in the same way as for bipolar transistors (out for nMOS, in for pMOS).

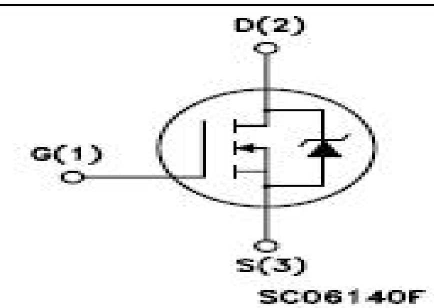
Comparison of enhancement-mode and depletion-mode MOSFET symbols, along with JFET symbols (drawn with source and drain ordered such that higher voltages appear higher on the page than lower voltages):



PIN DIAGRAM:



INTERNAL SCHEMATIC DIAGRAM



CHAPTER-2

LITERATURE SURVEY

2.1 MD Saquib Gadkari, et.al (2014) has shown the method of generating power by a ceiling fan. The generated power can be either used or can be stored in a battery for powering some other devices. The rotational energy of the dynamo can be used to operate several small powered devices. Both dynamo and alternator can be used. The various applications where this power can be used are charging of laptops, cell phones etc.

2.2 Vainy Pattanashetti, et.al (2015) has proved that designed as a generator set on the ceiling fan i.e. the magnets (neodymium)are placed with alternate poles on the stat or. By using the principle of Faraday' s law of electromagnetic induction the emf is being induced in the coil which further depends on the magnetic field strength and the relative motion between the magnetic field and the coil. The main benefit is that generation of power is possible without affecting the normal operation and parameters of the ceiling fan. Generated voltage can be stored in a battery, LED Bulbs can be glow as required or it can be stepped up using step up transformer and it can be further used for various applications. It regenerates nearly 40% of the total energy consumed by fan.

2.3 Akash Narayan Deshmukh (2016) they used power generative assembly which is fitted on the rod of fan for the production of electricity. The electricity generative fan works on the Faraday's law of electromagnetic induction. When fan is in working period, by using fan rotation energy rotates the magnets which placed around the copper winding in the power generative assembly. With the help of power generative assembly they produced electricity from the fan in it's working period. By using this assembly they produce electricity more effectively and efficiently.

2.4 Wakchaure Mahesh et.al (2016) has concluded that spinning energy of the dynamo, can be used to operate several small powered devices like a air conditioning compressor Both dynamo and alternator can be used. The various applications where this power can be used are charging of laptops, magnetic braking system, cell phones, semi-electric cars etc. this system used in car to increase the efficiency of engine more than today cars.

2.5 Neelesh Kumar (2017) has stated that Ceiling fan convert electrical energy into mechanical energy. In order to achieve the motive we have to convert this mechanical energy into electrical energy. This can be achieved with the help of Faraday Law of Electromagnetic Induction. According to Michael Faraday "whenever there is a relative motion between the coil and a magnet then an e.m.f is induced in the coil". He also stated that "the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of number of turns in the coil and flux associated with the coil”.

CHAPTER-3

METHODOLOGY

Introduction:

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in fig: 3.1:

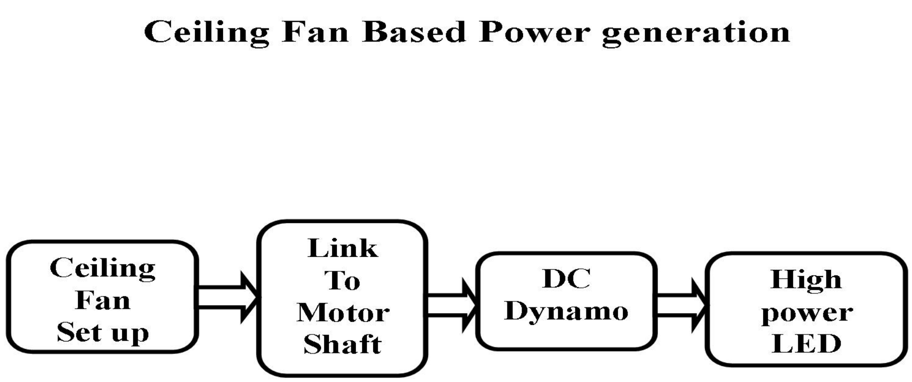


FIG 3.1: Block diagram of Ceiling Fan Based Power generation

The main blocks of this project are:

1. Ceiling fan set up
2. DC dynamo and High power LEDs

DESIGN & ANALYSIS

BATTERY:

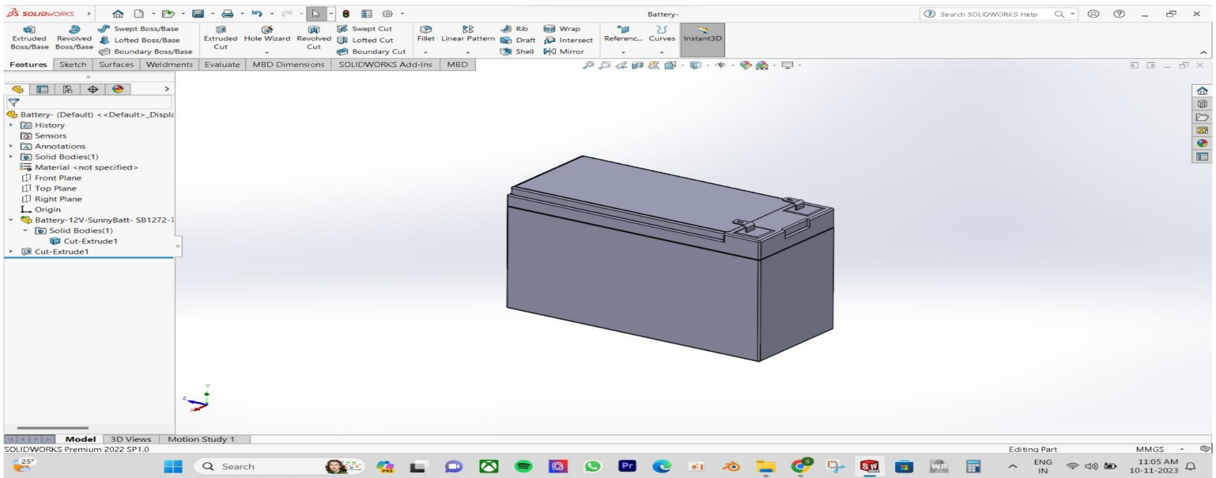


FIG 3.2: BATTERY

DC DYNOMO WHEEL:

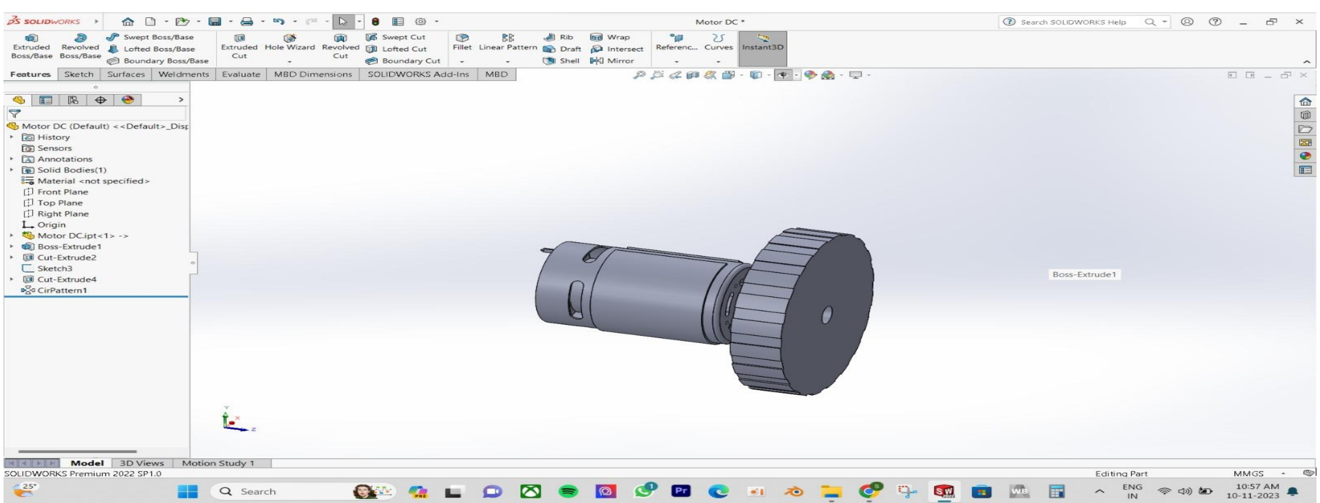


FIG 3.3: DC DYNOMO WHEEL

BULB:

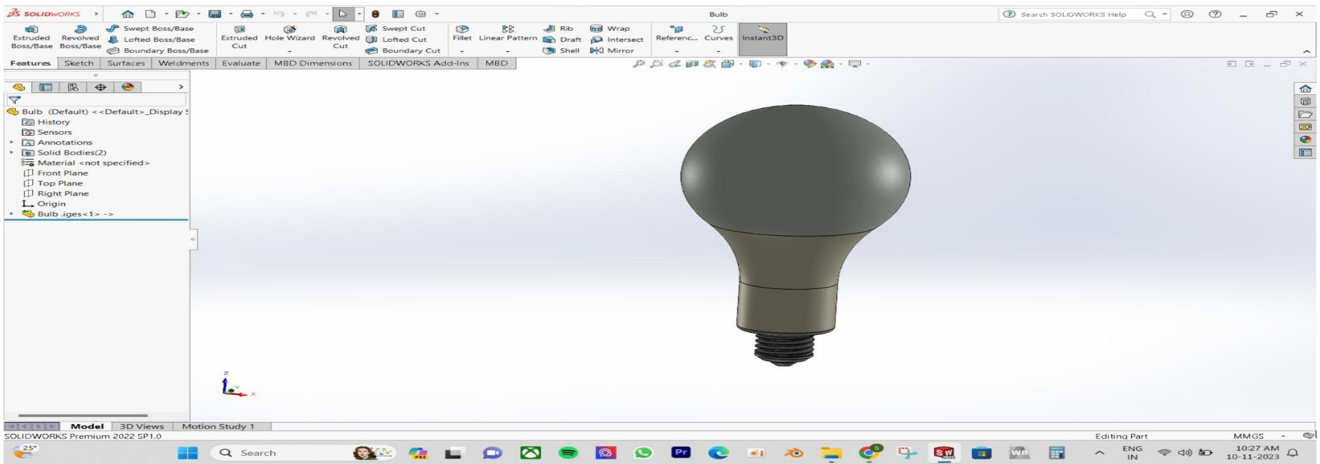


FIG 3.4:BULB

CEILING FAN:

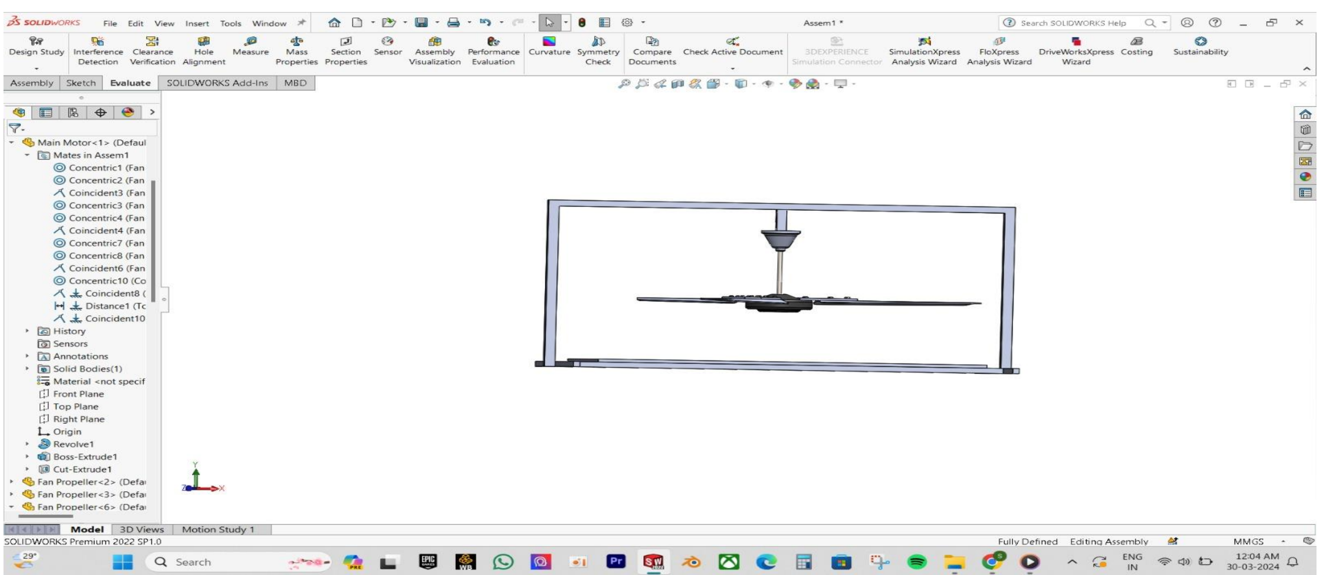
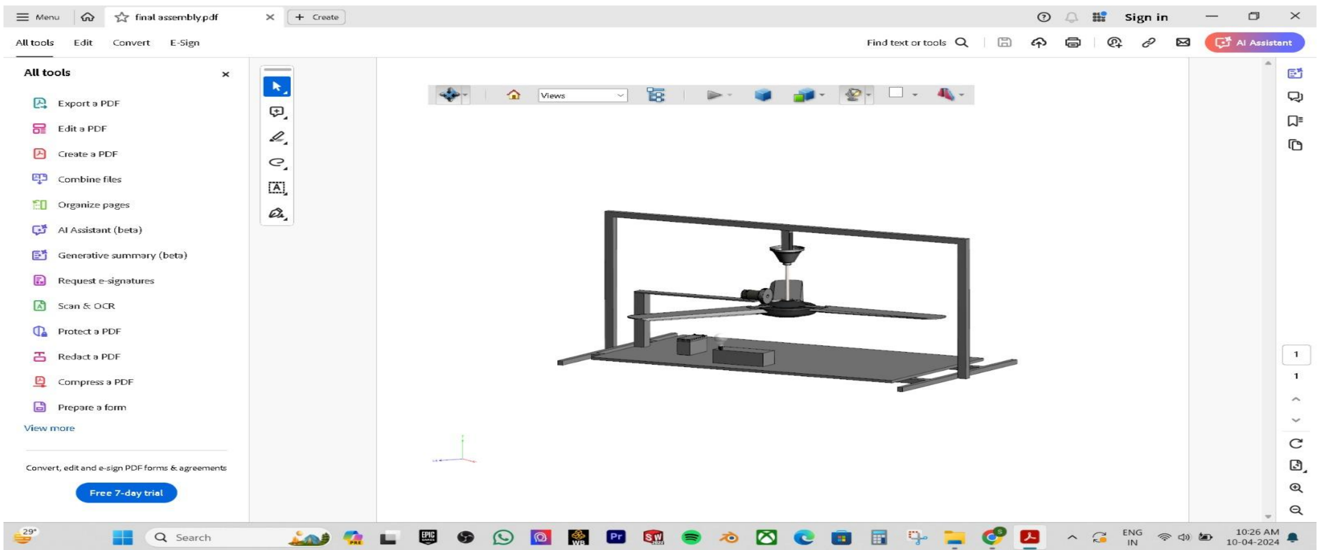
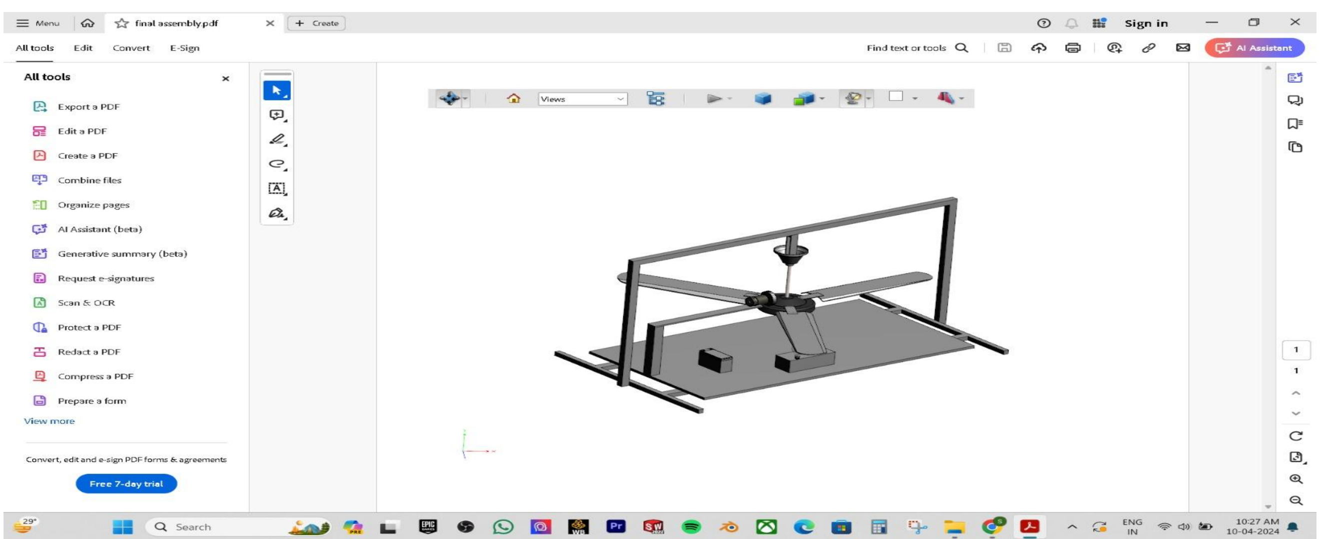


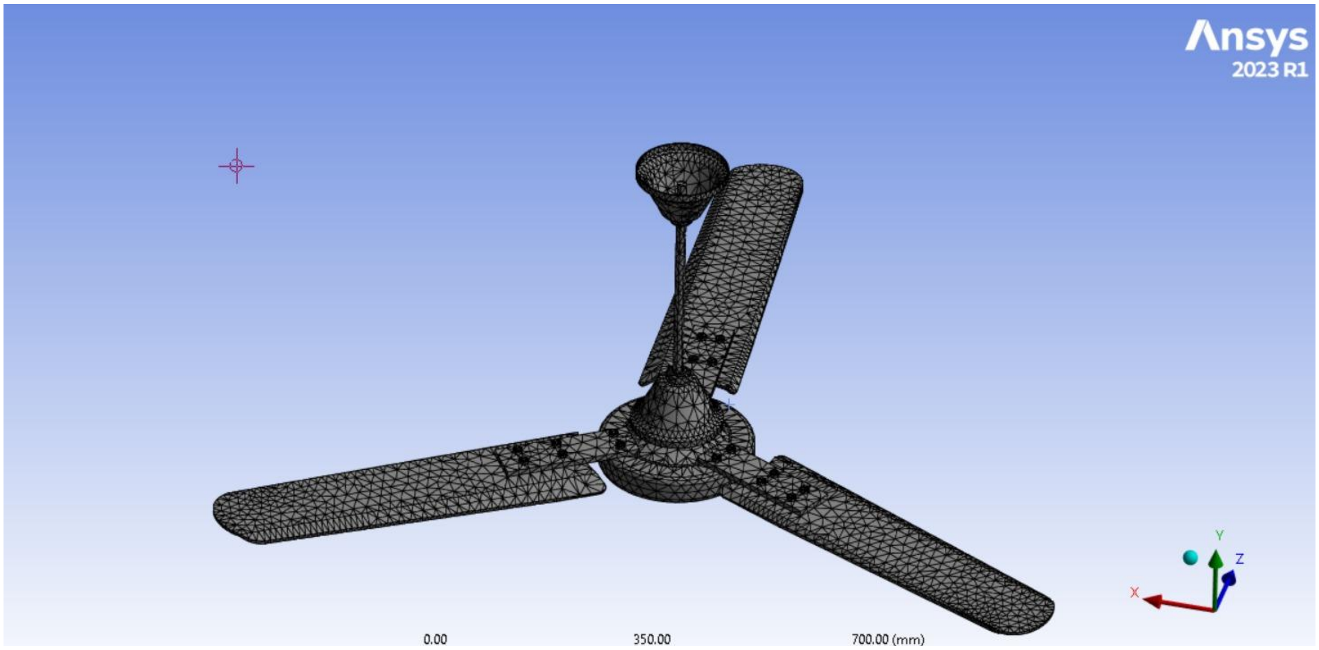
FIG 3.5: CEILING FAN

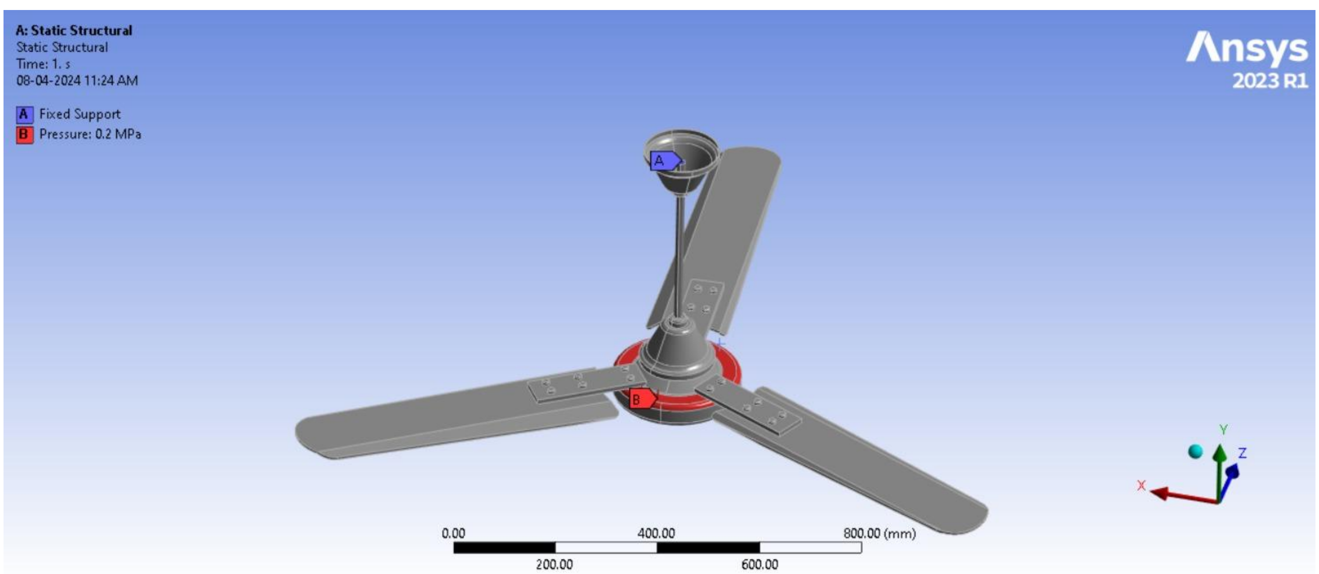
FULL DESIGN OF PROJECT:

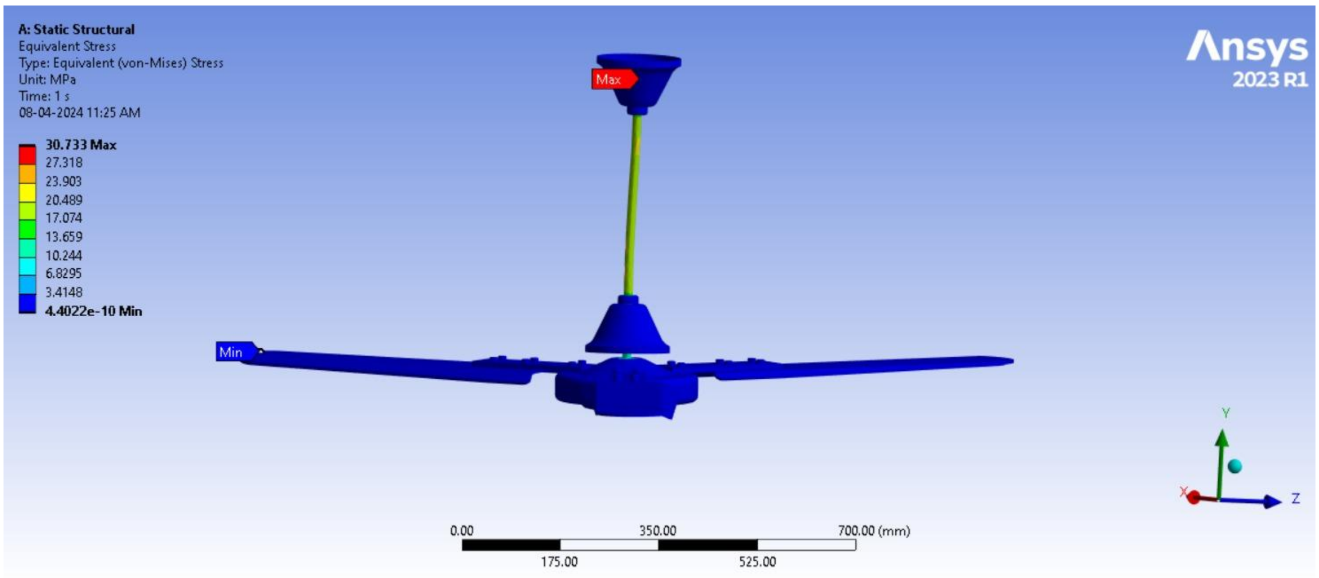


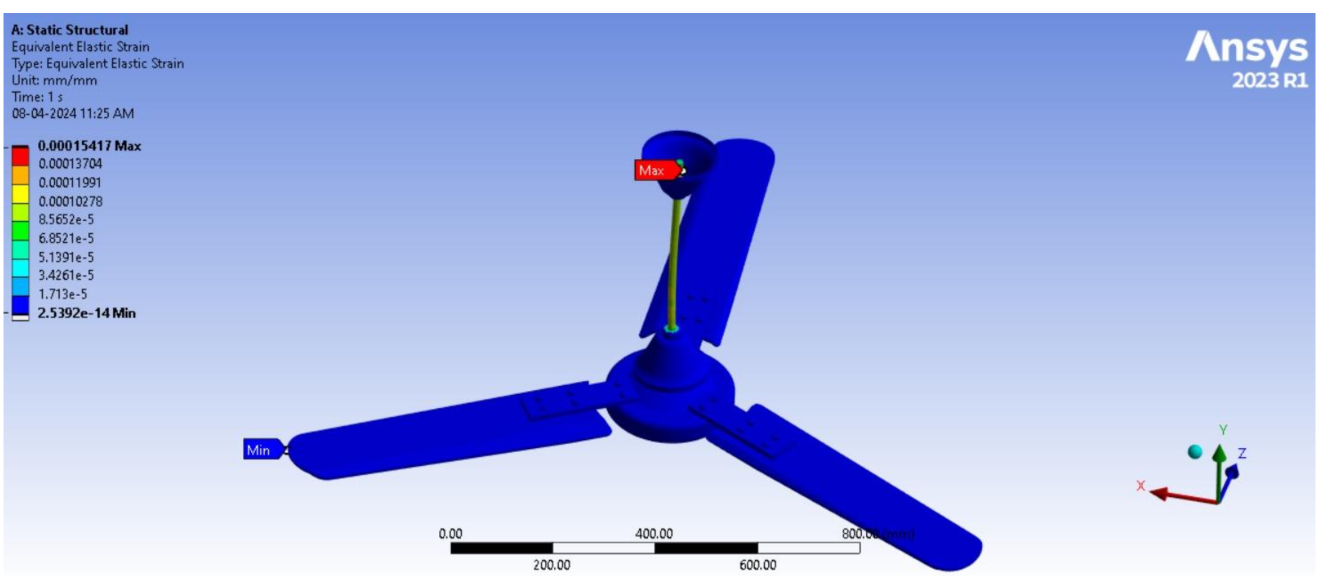


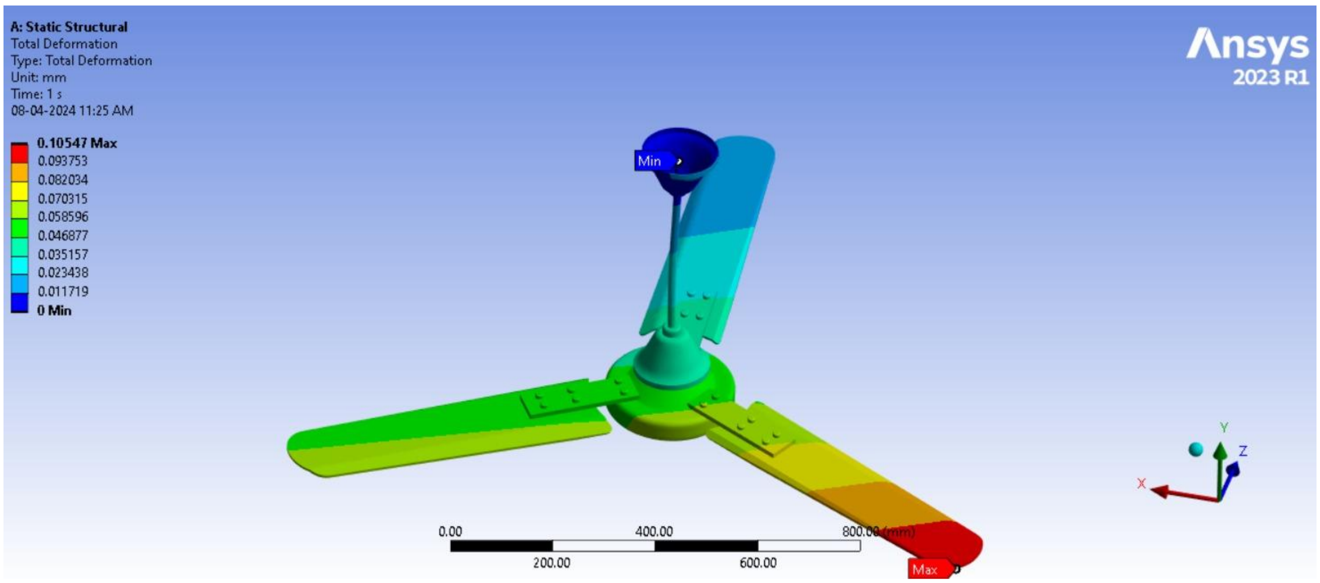
ANALYSIS:


Ansys
2023 R1
0.00
350.00
700.00 (mm)
Y
Z
X


A: Static Structural
Static Structural
Time: 1. s
08-04-2024 11:24 AM
A Fixed Support
B Pressure: 0.2 MPa
Ansys
2023 R1
A
B
0.00
400.00
800.00 (mm)
200.00
600.00
Y
Z
X


A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 1 s
08-04-2024 11:25 AM
30.733 Max
27.318
23.903
20.489
17.074
13.659
10.244
6.8295
3.4148
4.4022e-10 Min
Max
Min
Ansys
2023 R1
0.00
350.00
700.00 (mm)
175.00
525.00
Y
X
Z


A: Static Structural
Equivalent Elastic Strain
Type: Equivalent Elastic Strain
Unit: mm/mm
Time: 1 s
08-04-2024 11:25 AM
0.00015417 Max
0.00013704
0.00011991
0.00010278
8.5652e-5
6.8521e-5
5.1391e-5
3.4261e-5
1.713e-5
2.5392e-14 Min
Max
Min
Ansys
2023 R1
0.00
400.00
200.00
600.00
Y
Z
X


A: Static Structural
Total Deformation
Type: Total Deformation
Unit: mm
Time: 1 s
08-04-2024 11:25 AM
0.10547 Max
0.093753
0.082034
0.070315
0.058596
0.046877
0.035157
0.023438
0.011719
0 Min
Ansys
2023 R1
Min
Max
0.00
400.00
800.00 (mm)
200.00
600.00
Y
Z
X

3.1 ADVANTAGES AND APPLICATIONS

Advantages:

- This system helps in wind energy generation.
- Generating Electricity by using Mechanical arrangement.
- Reducing the Wastage of mechanical movement.
- Renewable energy generation.
- Single time investment.
- Efficient and low cost design.
- Easy to operate.

Applications:

- In industries, homes, etc which can be practically implemented in real time.

CHAPTER 4

RESULTS

4.1 Result:

SI NO	LOAD APPLIED	STRESS
1	1000N	30.733mpa

SI NO	LOAD APPLIED	STRAIN
1	1000N	0.00015417mm

SI NO	LOAD APPLIED	DEFORMATION
1	1000N	0.10547mm

CHAPTER 5
CONCLUSION

5.1 Conclusion:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

5.2 Future Scope:

Our project "**Ceiling Fan Based Power Generation**" is mainly intended to design to generate power by mechanical movement.

The future scope of this project is to add some gear arrangements for rotating the dynamo freely and also we can change the dynamo capacity. According to the dynamo capacity we can change the battery and Inverter circuits. So that we can run Heavy Loads.

REFERENCES

[1] Thompson, Sylvanus P., Dynamo-Electric Machinery. pp. 17

[2] Geoff Klempner, Isidor Kerszenbaum, "1.7.4 Equivalent circuit", Handbook of Large Turbo-Generator Operation and Maintenance, John Wiley & Sons, 2011 (Kindle edition) ISBN 1118210409.

[3] Electric machine by charles hubert.

[4] Faraday, Michael (1822). "On Some New ElectroMagnetical Motion, and on the Theory of Magnetism". Quarterly Journal of Science, Literature and the Arts (Royal Institution of Great Britain) XII: 74–96 (§IX). Retrieved 12 February 2013.

[5] "The Development of the Electric Motor,". Early Electric Motors. SparkMuseum. Retrieved 12 February 2013. [6] Pansini, Anthony J. (1989). Basic of Electric Motors. Pennwell Publishing Company. p. 45. ISBN 0-13-060070-9.