Different subassemblies of ac and dc generator engineering essay

P1: Draw diagram and write down the different subassemblies of AC and DC generator?

A. C. generator has coil of wire moving around into a magnetic field. With this assembly, a voltage is induced and this produce a current in a current

In a bicycle dynamo, a magnet turns inside a coil of wire when the back wheel of the bicycle is turning.

AC Generator:

DC Generator:

P2: Describe the of AC and DC generator and explain the difference between AC and DC generator-

Electricity is generated when a coil of wire moves in a magnetic field. This is the basis of electricity generators.

Most electricity is made in power stations by burning fuels. Transformers are used in the National Grid to reduce energy losses from the wires during transmission.

DC and AC electricity

DC electricity:

Batteries produce direct current, or DC, electricity. The current flows in the same direction all of the time, as shown by this typical voltage-time graph.

AC electricity:

Alternating current

Generators produce alternating current, or AC, electricity. The current reverses direction regularly, as shown by this typical voltage-time graph.

Mains electricity is AC. It has a frequency of 50Hz - 50 cycles per second.

When a wire is moved in a magnetic field, the movement, magnetic field and current are all at right angles to each other. If the wire is moved in the opposite direction, the induced current also moves in the opposite direction.

One side of a coil in a generator moves up during one half-turn, and then down during the next half-turn. This means that, as a coil is rotated in a magnetic field, the induced current reverses direction every half-turn.

P3: Explain photo-electric effect. Explain function of solar panels and describe their applications. Draw the diagram and define of different subassemblies of solar power system and explain the operation of solar power source.

Solar energy

Solar cells

Solar-powered ticket machine

Solar cells are devices that convert light energy directly into electrical energy. You may have seen small solar cells in calculators. Larger arrays of solar cells are used to power road signs in remote areas, and even larger arrays are used to power satellites in orbit around Earth.

Solar panels

Solar panels do not generate electricity, but rather they heat up water. They are often located on the roofs of buildings where they can receive heat energy from the sun. The diagram outlines how they work.

Cold water is pumped up to the solar panel, there it heats up and is transferred to a storage tank.

A pump pushes cold water from the storage tank through pipes in the solar panel. The water is heated by heat energy from the sun and returns to the tank. In some systems, a conventional boiler may be used to increase the temperature of the water.

Advantages

Solar energy is a renewable energy resource and there are no fuel costs. No harmful polluting gases are produced.

Disadvantages

Solar cells are expensive and inefficient, so the cost of their electricity is high.

Solar panels may only produce very hot water in very sunny climates, and in cooler areas may need to be supplemented with a conventional boiler.

Although warm water can be produced even on cloudy days, neither solar cells nor solar panels work at night.

P4: Describe different type's electrical source of energy. Describe construction, application, characteristics and disposal of chemical cell/batteries e. g. (alkaline, acid & metal):

Types of chemical cell/batteries:

Alkaline:

Long-life batteries giving up to six times the life of ordinary zinc carbon batteries.

Ideal for appliances demanding a high current drain when being used on an intermittent or continuous basis.

Rechargeable Alkaline:

Offers the benefits of standard Alkaline cells but with rechargeable capability.

Also more beneficial than NiMH cells due to; 1. 5v, initially fully charged

Can be stored up to 7 years charged

Can be charged 50 times (although a 500 times may be possible)

N. B. These batteries can only be charged using an Alkaline Battery Charger.

Silver Oxide:

Silver oxide batteries have the most stable voltage characteristics among all types of button-type batteries, as well as delivering the highest performance

Silver oxide batteries use silver oxide for the positive active material. The negative active material is zinc, and the electrolyte is potassium hydroxide

Because of the use of these materials, the silver oxide batteries have a higher operating voltage and an extremely stable power supply. The nominal open-circuit voltage is 1. 55 volts

Silver oxide batteries are also far superior in heavy drain uses and suitable for the use in cameras and exposure meters.

Disposing:

These batteries should be recycled when disposing of them, reason being because of environmental issues. These batteries will not decompose so this could effect the environment

P5: Define the following terminology with the reference to electrical properties conductor, insulator, semi conductor, resitivity, tensile strength:

Conductor:

Conductor makes the electric current flow freely. It is mostly made out from copper, having high resistance to the flow of charge through them. Conductor involves the outer electrons of the atoms are loosely bound and free to move through the material. In a conductor such as copper electrons are essentially free and strongly repel each other. Simply stated, most metals are good electrical conductors, most non-metals are not. Metals are also generally good heat conductors while non-metals are not.

Insulator:

Insulator does not flow freely like conductor does, most non-metallic solids are good insulators. Most atoms hold on to their electrons tightly and are

insulators. Insulators offer large amount of resistance to the flow of electric current.

Semi-conductor:

Is an element which neither is a good conductor or a good insulator, but rather lies somewhere in between the two. Characterized by a valence shell containing four electors. Silicon, germanium and carbon are the semi-conductors most frequently used in electronics.

Resistivity:

Resistance controls the flow of current and is identified in ohms. Electrical resistivity is a measurement of how robustly a material resist the flow of current. A high resistivity show a material doesn't freely allows the movement of electrical whereas low resistivity shows a material that readily allows the movement of electrical charge.

Tensile Strength:

Is a rigorous property of the material is the maximum amount of tensile stress that it can be subjected to before failure. . It is an intensive property of the material, which not only depends on the type of material but also the preparation of the specimen and the temperature of the test. The definition of failure can vary according to material type and design methodology

P6: Describe the insulating properties solid, liquid and gas with at least one example of each material considering to the following points;

Maximum voltage capability

Mechanical strength

Effect of temperature

P7: Describe in detail and use diagram in support of your explanation.

Geothermal energy

You should be able to outline how electricity is generated from geothermal energy.

Volcanic areas

Several types of rock contain radioactive substances such as uranium. Radioactive decay of these substances releases heat energy, which warms up the rocks. In volcanic areas, the rocks may heat water so that it rises to the surface naturally as hot water and steam. Here the steam can be used to drive turbines and electricity generators. This type of geothermal power station exists in places such as Iceland, California and Italy.

Hot rocks

In some places, the rocks are hot, but no hot water or steam rises to the surface. In this situation, deep wells can be drilled down to the hot rocks and cold water pumped down. The water runs through fractures in the rocks and is heated up. It returns to the surface as hot water and steam, where its

energy can be used to drive turbines and electricity generators. The diagram below shows how this works.

Step-up Transformer:

Step-Up Transformers are one of the really common and vital electrical tools used in power transmission and modification. They are usually the first major transformer in a transmission system and are often used in various forms throughout the system.

Step-down Transformer:

Step down transformers are designed to reduce electrical voltage. Their primary voltage is greater than their secondary voltage. This kind of transformer " steps down" the voltage applied to it. For instance, a step down transformer is needed to use a 110v product in a country with a 240v supply.

P8: Describe Applications of electrical technology and, for each of them, describe how electrical energy is used to enable them to function.

Wind Power

Wind power generators are rarely seen in isolation as they are normally put together in groups forming wind farms. This is the most efficient way of producing electricity from the wind and feeding it into the national power grid. Single generators are normally much smaller and used on farms or in remote areas where it is not possible to cable electricity from the national grid. Wind farms tend to be located in the countryside were they are away from towns and people. Many people believe that these large structures spoil

the look and piece of the countryside. Wind generators create a lot of noise. It is said that each one is as loud as a car engine running at 70 MPH.

Some technologists and scientists believe the answer is to site large wind generators at sea. The noise they produce will not be heard and if sited miles way from the coast they will not even be seen. However, they are much more costly to locate and maintain in the sea. Also, the salt in sea water means that the materials used to make them have to be specially treated so that they are protected. This increases there overall cost of manufacture and installation significantly. However, this may be the future for the large scale production of electricity through wind powered turbines.

Wave Power

The power of the waves can be used to produce electricity. Most systems concentrate on creating electricity directly from the force of water. However, an 'Oscillating Water Column' works as the wave enters the lower chamber, it forces air into the upper chamber and this causes the turbines to rotate. The advantage of this type of system is that the propellers are out of the sea water which means they are not affected by the salty water.

The PENDULUM device is another electricity generating device that utilises the power of waves, as the wave hits the pendulum it is forced backwards and then returns to its original position until the next wave hits. This movement forces hydraulic ramps backwards and forwards which drive special turbines and produces electricity.

Hydroelectricity

Hydro power is an alternative way of producing electricity from the power produced by water under pressure. A typical setup requires the construction of a dam. This would be situated at the head of a valley. Behind the dam, water is allowed to build up forming a large, deep lake. The deeper and larger the lake, the greater the potential of producing large amounts of electricity. A typical dam may take years to construct and cost millions of dollars / euros and consequently a dam must stay producing electricity for many years (perhaps even decades) - in order to produce electricity profitably. The Hoover Dam in the USA was opened in 1936 and is an excellent example of this type of dam.

The lake behind the dam contains millions of gallons of water and it is the pressure/weight from the 'head' of water that is used to drive turbines producing electricity. The water is release through sluice gates well below the water line. The weight of the water above forces water through the sluice gates at high speed. This speed drives the turbines round producing large amounts of electricity. The diagram below shows how electricity is produced.

Piezo-electric actuators

Piezo-electric actuators work in two ways; they either produce movement in response to an applied voltage or they produce a voltage in response to an applied pressure. Piezo-electric actuators are used in greetings cards that play tunes when opened. They produce a sound from an electrical signal as a result of the card being opened.

When piezo-electric transducers are used as sensors they are capable of picking up small signals that can then be amplified and processed. They are used in a wide variety of applications including burglar alarms. The transducer produces a voltage in response to a loud sound, such as a breaking window, or to a movement such as treading on a mat or stair tread.

The transducers are made from minerals, ceramics or polymers. The piezo-electric film is bonded to a base material once coated with a metallic film and contacts are then attached. In some cases amplifier circuits are built in to the whole transducer but in most examples they are left like the examples below.

The voltage generated as a result of the material being deformed is sufficient enough to light an LED as shown below

M1: Compare and contrast the features of three prime energy sources that are in general use for the production of electricity by mechanically driving an electromagnetic generator. Explain in detail advantages and disadvantages of three electrical source of energy e. g. nuclear, thermal and steam turbine?

Nuclear:

Advantages

There is roughly 0 emission, which means it produces electricity without pollution.

Doesn't take fossil fuels which is getting more & more expensive

They can be sited almost anywhere unlike oil which is mostly imported

A lot of energy from a single power plant

The advantage is a clean burning fuel that can provide energy for hundreds of miles at a time.

Disadvantages:

More expensive to build

Waste product is harmful and need to be carefully stored for long time

Produce radioactive waste which needs to be contained carefully

Nuclear power plants can be dangerous to its surroundings and employees. There has been a case where a plant has gone through a meltdown and as a result left people dead and its surroundings destroyed.

Thermal:

Advantages:

Thermal energy is the easiest to find and create.

Geothermal energy is a renewable energy resource and there are no fuel costs.

No harmful polluting gases are produced

Disadvantages:

It is necessary in some situations (for example, chemical processes where molecular motion is necessary

Most parts of the world do not have suitable areas where geothermal energy can be exploited.

Hydroelectricity:

Advantages:

Once a dam is constructed, electricity can be produced at a constant rate.

If electricity is not needed, the sluice gates can be shut, stopping electricity generation. The water can be saved for use another time when electricity demand is high.

Dams are designed to last many decades and so can contribute to the generation of electricity for many years / decades.

The lake's water can be used for irrigation purposes.

The build up of water in the lake means that energy can be stored until needed, when the water is released to produce electricity.

When in use, electricity produced by dam systems does not produce green house gases. They do not pollute the atmosphere.

Disadvantages

Dams are extremely expensive to build and must be built to a very high standard.

The high cost of dam construction means that they must operate for many decades to become profitable.

The flooding of large areas of land means that the natural environment is destroyed.

People living in villages and towns that are in the valley to be flooded, must move out. This means that they lose their farms and businesses. In some countries, people are forcibly removed so that hydro-power schemes can go ahead.

The building of large dams can cause serious geological damage. For example, the building of the Hoover Dam in the USA triggered a number of earth quakes and has depressed the earth's surface at its location.

Dams built blocking the progress of a river in one country usually means that the water supply from the same river in the following country is out of their control. This can lead to serious problems between neighbouring countries.

Differences:

There are many differences between nuclear, thermal and hydro-electricity. These three types of energy production have different ways of generating energy (electricity). There is also the cost of making the generator in order to produce energy, hydro-electricity is much more expensive compared to nuclear. There is also the waste that the generators produces e. g. Nuclear produces harmful substances that need to be dispose or stores whereas hydroelectricity does not product and waste.

Similarities:

One of the main similarities between nuclear, thermal and hydro-electricity is that there are all sources of renewable energy. These types of energy sources have different ways of producing energy but produces renewable energy.

M2: Explain the reasons for the use of a range of voltages in an electricity supply system. In electricity supply systems from point of generation to distributions there are many different types of voltage are being used explain what the importance of these types of voltages is?

When generators supply electrical energy is uses step-up transformer that can go up to 25, 000V so electricity can be supplied to far distance to every homes and businesses. The power station distributes electricity

D1: Justify the use of different energy sources, including fuels and renewable sources, to provide a nation's electricity supply

In different areas around the world there are different environments to be considered when using different types of energy sources. In places such as South Africa, it is too expensive to supply fuel energy to places like the villages. Instead in these sorts of places, they use renewable sources of energy such as solar energy. This is a good benefit for the people who live in such an environment because it stays sunny most of the time, the energy is supplied constantly. Not only that, but after setting up the supply the energy is then free.

But in places such as the UK it is different. Right now the main supply of energy sources is from fuels. The reason being is because it is much cheaper at the moment. Another reason is using solar energy is not a sufficient enough because of lack of sun. But the UK will use wind power which will be place into the sea. Constructing these big wind turbines is expensive but it could provide enough energy for a city etc.

But using fuel to create electrical energy harms the environment. Creating energy using fuels harms the environment such as causing holes in the o-zone layer. There are advantages on using fuel energy such as large amounts of electricity can be generated in one place using coal, fairly cheaply. But there are more disadvantages such as fuels causes pollution, burning any fossil fuel produces carbon dioxide, which contributes to the greenhouse effect, warming the Earth and also fuels are non-renewable so once the fuel is burn that is it, there is no more.

With renewable energy the only fall back about it is the fact that it is most of the time expensive to set up. But when setted up, the energy is absolutely free. The main benefit of renewable energy is that it does not cause pollution which fuel does.

D2: Explain and justify how a practical application of electrical technology could be improved by making effective use of available technologies. (D2)

With the reference to manufacturing industry automated processes, robotics and control systems

With the reference to healthcare magnetic resonance imaging (MRI) scanners, operating theatre uninterruptible power supplies (UPS).

CNC:

There are many automated processes such as CNC. A CNC (Computer Numeric Controls) milling machine uses CAD/CAM cutter paths to cut away metal blocks into the various parts of an injection mold and then add the cavities and ejector pin holes. This produces anything from CPU's to motherboards. The great thing about this technology is that there are many benefits such as

Rapid manufacturing

Can be run 24/7

Can be easy to design using software

MRI:

MRI is a special radiology technique designed to image internal structures of the body using magnetism, radio waves, and a computer to produce the images of body structures. MRI creates better pictures than a CT scan or X-ray, because it can show both healthy and diseased tissues. MRI is ideal for:

Diagnosing multiple sclerosis (MS)

Diagnosing tumors of the pituitary gland and brain

Diagnosing infections in the brain, spine or joints

Visualizing torn ligaments in the wrist, knee and ankle

Visualizing shoulder injuries

Diagnosing tendonitis

Evaluating masses in the soft tissues of the body

Evaluating bone tumors, cysts and bulging or herniated discs in the spine

Diagnosing strokes in their earliest stages

UPS:

UPS is primarily used as a backup power source for computers and computer networks to insure on-going operation in the event of a power failure. Sophisticated units also have power conditioning and power monitoring features.