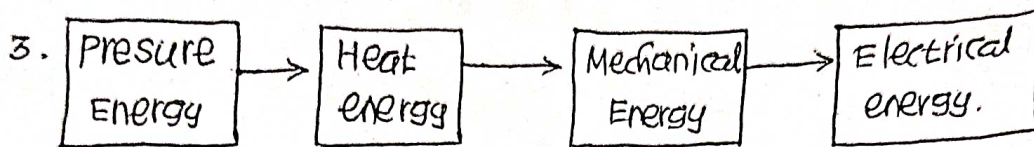


Gas Turbine power plant :

(A) Working principle of gas turbine power plant :

1. Natural gas is used as fuel.
2. Air is compressed to a high pressure and heated by means of the flue gases.

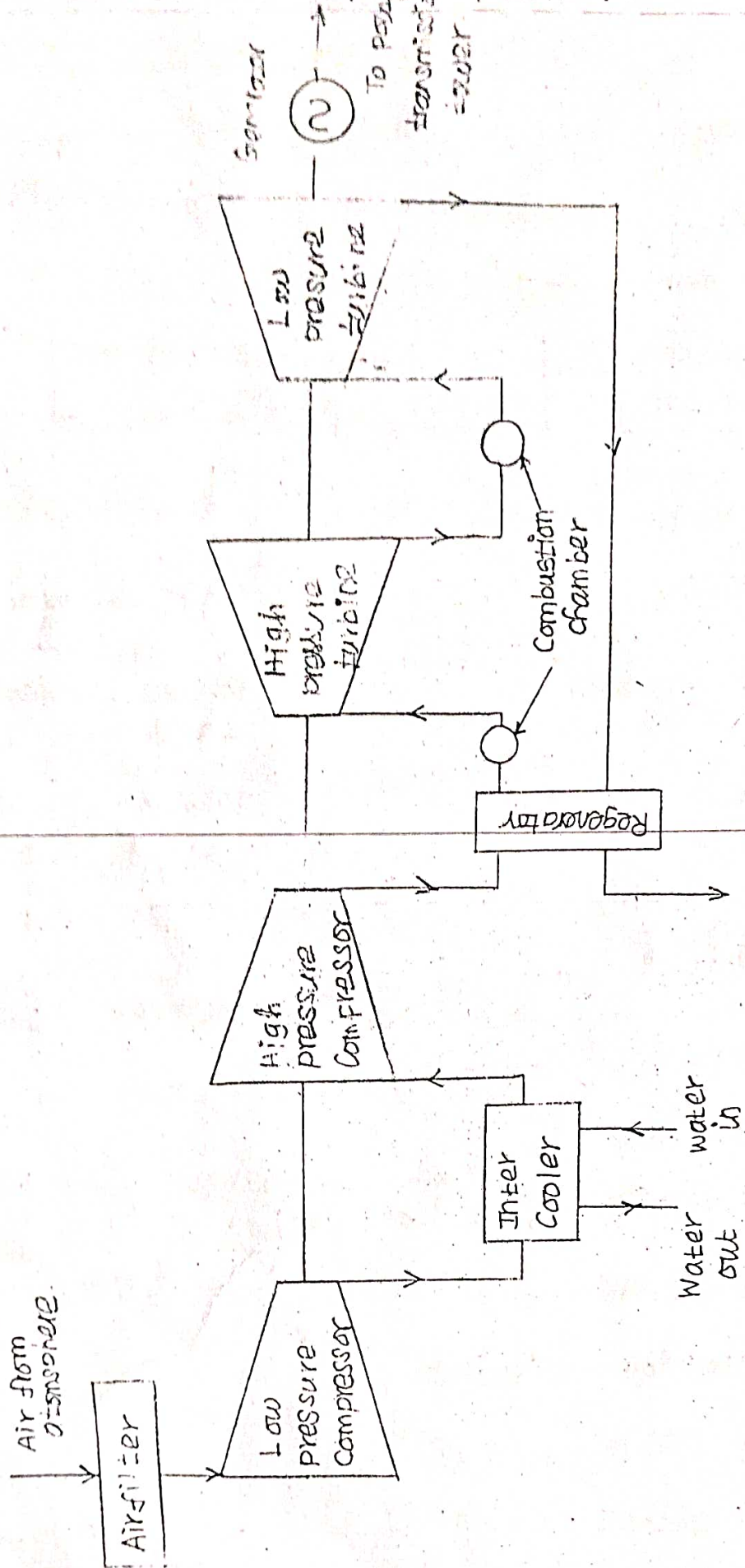


Device	Energy Conversion.
Compressor	Air \rightarrow Pressure Energy.
Combustion chamber	Pressure \rightarrow Heat Energy [Air+Fuel] energy
Turbine	Heat energy \rightarrow Mechanical Energy.
Generator	Mechanical Energy \rightarrow Electrical Energy.

(B) Component of gas turbine power plant :

1. Low pressure Compressor. [LPC]
2. Inter Cooler.
3. High pressure Compressor. [HPC]
4. Regenerator.
5. Combustion chamber.
6. High pressure turbine [HPT]
7. Low pressure turbine [LPT]

Layout of Gas turbine power plant :



Layout of gas turbine power plant.

1. Low pressure Compressor [LPC] :

Air from the atmosphere is drawn into the LPC through air filter and is compressed.

2. Intercooler :

(i) The purpose of intercooler is to reduce the temperature of air entering into the high pressure compressor.

(ii) Intercooler is used to reduce the work of the compressor and increase the efficiency.

3. High pressure Compressor [HPC] :

(i) The cooled air coming out of the intercooler is further compressed in the high pressure compressor.

(ii) The pressure and temperature of air further increases in the high pressure compressor.

4. Regenerator :

Regenerator is used to preheat the air entering the combustion chamber by using the heat of hot exhaust gases from the turbine.

5. Combustion chamber :

(i) Hot air enters from the regenerator and fuel is injected into the combustion chamber.

(ii) Combustion takes place and the gases at high temperature and pressure are passed to the turbine.

6. High pressure Turbine [HPT]:

(i) Hot combustion gases expanded in the high pressure turbine.

(ii) Almost 65 to 70% of the total power is ~~developed~~ ^{developed} in this stage.

7. Low pressure Turbine [LPT]:

(i) The gases run the LPT and then pass to the atmosphere through regenerator.

(ii) Almost 30 to 35% of the power is developed in this stage.

(1): Advantages of gas turbine power plant:

1. Initial cost is less.
2. Maintenance cost is less.
3. It can operate at high speed.
4. used in water scarcity areas.
5. Less pollution.

(2): Disadvantages of gas turbine power plant:

1. Life of the plant is less.
2. special cooling methods are required.
3. poor part load efficiency.
4. operating temperature is high.
5. overall efficiency of the plant is very less.

V. Nuclear power plant:

(A) Working principle of Nuclear power plant:

1. Uranium is used as nuclear fuel.
2. Principle involved is nuclear fission.

(B) Components of Nuclear power plant:

1. Reactor core.
2. Control rods.
3. Moderator.
4. Coolant.
5. ^{Thermal} shielding.
6. Steam generator.
7. Turbine.
8. Condenser.
9. Feed pump.

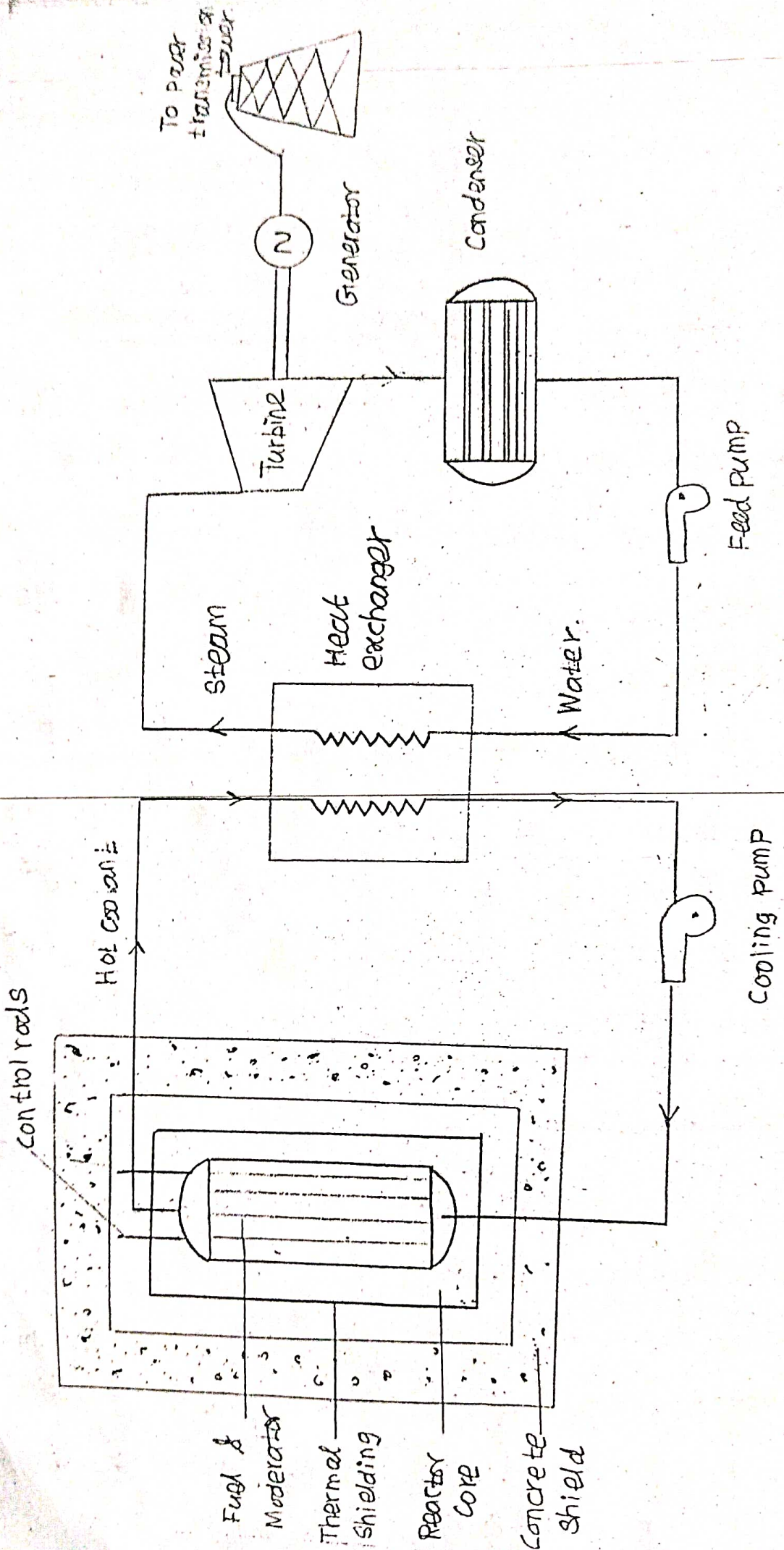
(C) Layout of Nuclear power plant:

1. Reactor core:

(i) It consists of fuel elements, control rods, coolant and moderator.

(ii) Nuclear fission reaction takes place in reactor core.

Nuclear Reactor



2. Control rods :

- (i) Control rods are inserted into the reactor core from the top of the reactor.
- (ii) Function of control rods is to absorb the excess neutrons and to control the chain reaction.
- (iii) Control rod is also used to start and stop the nuclear chain reaction.

3. Moderator :

- (i) Moderator is a material which is used to slow down the fast neutrons.
- (ii) Moderator materials are graphite, ~~and~~ heavy water, carbon, and beryllium.

4. Coolant :

- (i) Coolant absorb the heat generated in the core.
- (ii) Commonly used coolant are water, liquid sodium.

5. Thermal shielding :

- (i) It is made up of steel.
- (ii) It surrounds the entire reactor core and it absorbs radiations and escaping neutrons.

6. Heat Exchanger :

- (i) Heat Exchanger is used to transfer the heat carried by the coolant to water.
- (ii) Water gets converted into steam while passing through the heat exchanger.

7. Turbine :

The steam is passed through a steam turbine where the thermal energy of steam is further used for generating electric power.

8. Condenser :

(i) The steam coming from the turbine is passed to the condenser.

(ii) Steam is converted into water by circulating cold water around the condenser tubes.

9. Feed pump :

The feed pump pumps the condensed water from the condenser to the steam turbine.

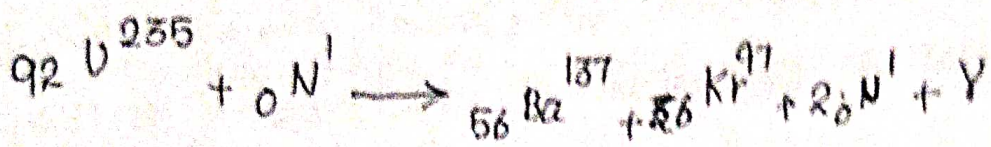
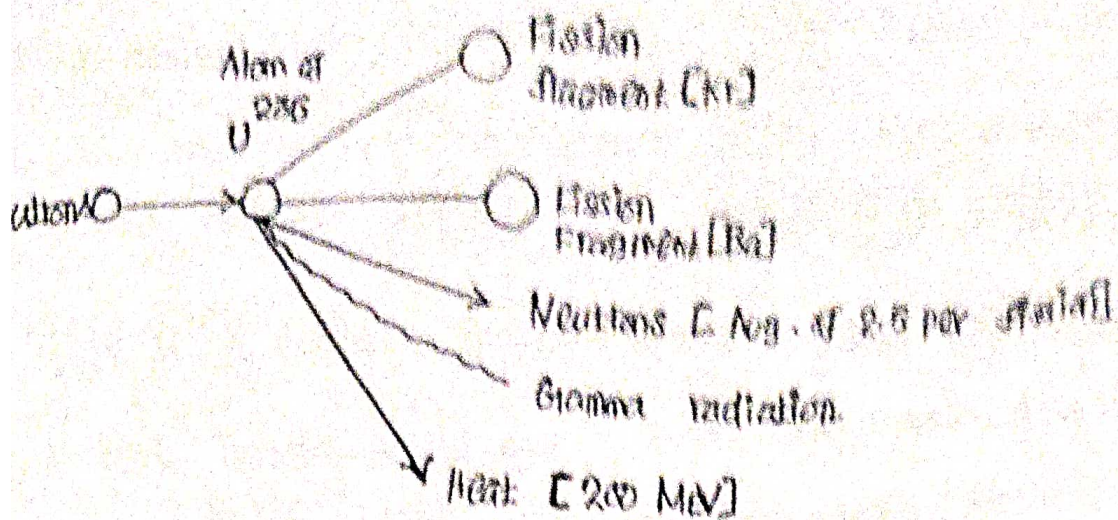
(d) Advantages of Nuclear ~~Power~~ power plant :

1. No ash disposal problems.
2. Not affected by adverse weather conditions.
3. Fuel consumption is very small.
4. Suitable for large power requirements.
5. Less number of workers are needed.

(e) Disadvantages of Nuclear power plant :

1. High initial and maintenance cost.
2. Not suitable for varying load conditions.
3. Radioactive wastes may affect the workers health and other surroundings.
4. Disposal of radioactive waste is major problem.
5. Well trained personnel is required for operations.

Nuclear Fission :



1. It is the process of breaking a heavy nucleus with into two or more light fragments with liberation of large amount of energy.
2. Nearly one thousand of the mass can get converted into energy.
3. This process takes place spontaneously at ordinary temperature.
4. Fission process emits radioactive rays.
5. Neutrons are emitted as a result of fission reaction.
6. It can be performed under controlled conditions.

Difference between Nuclear fission and Nuclear fusion :

Nuclear fission

1. It is the process of breaking heavy nucleus into two or more light fragments with liberation of large amount of energy.
2. Nearly one thousand of mass can get converted into energy.
3. This process takes place spontaneously at ordinary temperature.
4. Fission process emits radioactive rays.
5. Neutrons are emitted as a result of fission reaction.
6. It can be performed under controlled conditions.

Nuclear fusion.

1. It is a process of fusing two light nuclei into single nucleus with the liberation of large amount of heat.
2. Nearly four thousand of mass can get converted into energy.
3. This process takes place at high temperature.
4. Fusion process emits very less number of radioactive rays.
5. Protons are emitted as a result of fusion reaction.
6. It can^{not} be performed under controlled conditions.

Comparison between steam power plant with Hydel power plant :

Steam power plant	Hydel power plant.
<ul style="list-style-type: none"> Initial cost is low. 	<ul style="list-style-type: none"> Initial cost is high.
<ul style="list-style-type: none"> Maintenance and labour costs are high. 	<ul style="list-style-type: none"> Maintenance and labour cost are low.
<ul style="list-style-type: none"> power generation does not depends on natural mercy. 	<ul style="list-style-type: none"> power generation depends on the natural mercy.
<ul style="list-style-type: none"> It is not suitable for peak load plant. 	<ul style="list-style-type: none"> It is suitable for peak load plant.
<ul style="list-style-type: none"> Transmission losses are less Less Efficiency. 	<ul style="list-style-type: none"> Transmission losses are high More Efficiency.
<ul style="list-style-type: none"> Quick starting is not possible. 	<ul style="list-style-type: none"> Quick starting is possible.
<ul style="list-style-type: none"> Coal and ash handling problem arises. 	<ul style="list-style-type: none"> No coal and ash handling problem.
<ul style="list-style-type: none"> Air pollution is more. 	<ul style="list-style-type: none"> Air pollution is less.
<ul style="list-style-type: none"> power generation cost is more. 	<ul style="list-style-type: none"> power generation cost is less.
<ul style="list-style-type: none"> Construction time is less. 	<ul style="list-style-type: none"> construction time is more.
<ul style="list-style-type: none"> Fuel transportation is difficult. 	<ul style="list-style-type: none"> No fuel transportation.
<ul style="list-style-type: none"> It requires more cooling water. 	<ul style="list-style-type: none"> It requires less cooling water.
<ul style="list-style-type: none"> plant load factor is, low. 	<ul style="list-style-type: none"> plant load factor is high.

15. High lubrication cost.

low lubrication cost.

16. life of the plant is less.

life of the plant is high

Comparison between Thermal power plant with nuclear power plant.

Thermal power plant

Nuclear power plant.

1. Fuel storage space is required.

No fuel storage space

2. Capital cost is high.

capital cost is less.

3. No radioactive material.

Radioactive wastes.

4. space requirement is high.

space requirement is less

5. Maintenance cost is less.

Maintenance cost is high

6. Large quantity of fuel required.

Less quantity of fuel required

7. It will be affected by weather conditions.

It will not be affected by weather conditions.

8. It requires large quantity of water.

It does not require large quantity of water.

9. operating cost is high.

operating cost is less.

10. Efficiency is low.

Efficiency is high.

Comparison between diesel power plant and gas turbine power plant:

Diesel power plant

1. Efficiency is 35 to 42%.
2. Life of the plant is less.
3. High lubrication cost.
4. Particular fuel should be used.
5. Cost of the plant is less.
6. plant capacity is limited.
7. High work output.

Gas turbine power plant:

Gas turbine powerplant.

Efficiency is 20 to 25%.

Life of the plant is more.

Less lubrication cost.

Variety of fuel can be used.

Cost of the plant is high.

plant capacity is limited.

Less work output.