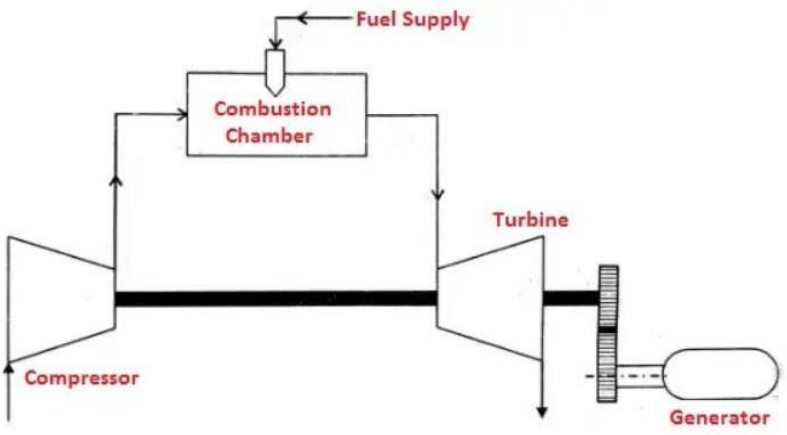
EE3035 GRID INTEGRATING TECHNIQUES AND CHALLENGES

UNIT I

Gas-Based Power Generation

A gas turbine is a type of IC engine that uses compressed gas to generate mechanical power. This mechanical power is further used to run a gas generator which converts this mechanical power into electricity.



Gas Turbine Power Plant

Components of Gas Turbine Power Plant

Following are the components of a gas turbine power plant:

- Compressor
- Combustion chamber
- Vertex blading
- Turbine
- Regenerator
- Intercooler

Working of Gas Turbine Power Plant

A schematic diagram of a gas turbine power plant is shown in the figure. It consists of a compressor, turbine, and combustion chamber.

Part of the power developed by the turbine is used to drive the compressor and other auxiliary equipment, and the remaining is used for power generation. The gas coming out of the turbine is exhausted into the atmosphere. This cycle is known as an open-cycle power plant.

If the gas coming out from the turbine is cooled to its original temperature in a cooler and then it is recirculated to the compressor for doing work, such a cycle is known as a closed-cycle power plant.

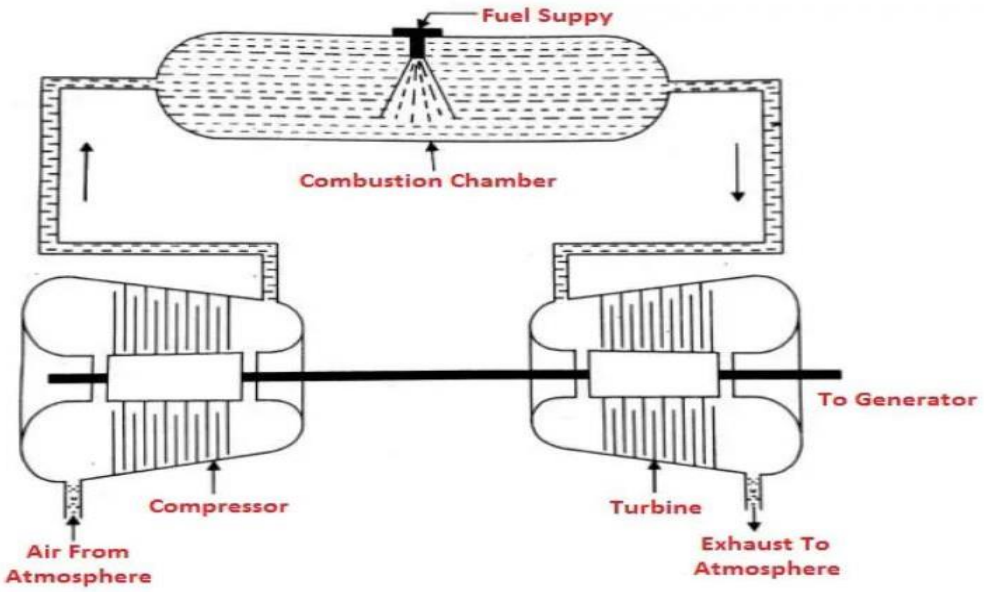
Types of Gas Turbine Power Plant

The gas turbines can be classified into:

- Open cycle gas turbine power plant
- Closed cycle gas turbine power plant

Open Cycle Gas Turbine Power Plant

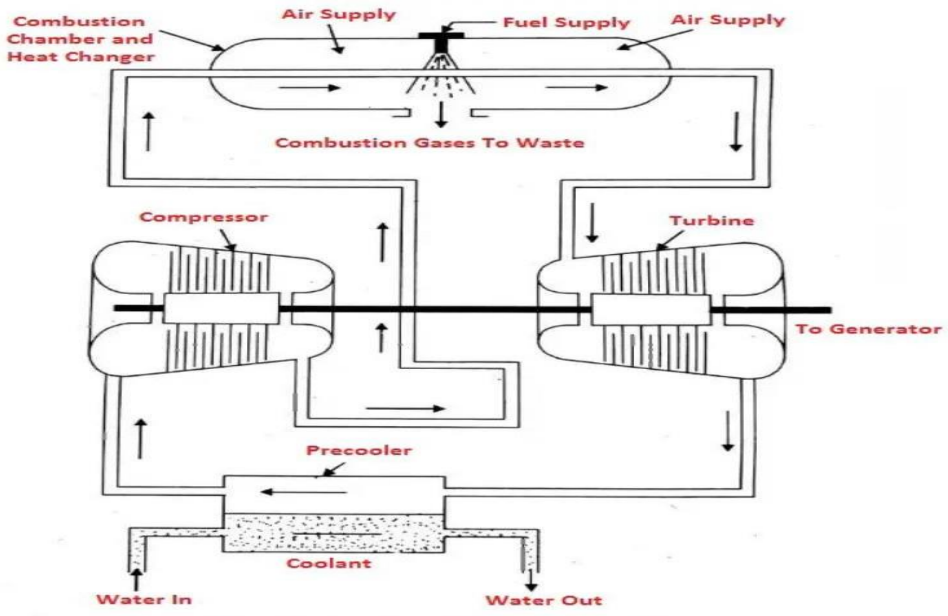
Simple construction and working of an open cycle gas turbine power plant as shown in the figure. It consists of a compressor, combustion chamber, turbine, and generator. The compressor takes the ambient air and raises its pressure by compression.



Open Cycle Gas Turbine Power Plant

Closed Cycle Gas Turbine Power Plant

Simple construction and working of a closed cycle gas turbine power plant as shown in the figure. It consists of a compressor, combustion chamber, turbine, generator, and precooler. The working fluid may be air or any other suitable gas coming out from the compressor with high pressure and is heated in a heater by an external source at constant pressure.



Closed Cycle Gas Turbine Power Plant

Advantages of Gas Turbine Power Plant

A gas turbine power plant has a number of advantages, which are listed below.

- In comparison to a thermal power plant of the same generating capacity, the capital and operating costs of a gas turbine power plant are significantly lower.
- Gas turbine power plants are simpler to design and lay out than thermal power plants since boilers and their auxiliary equipment are not necessary.
- It's easy to start up a gas turbine power plant in cold conditions.
- There is no need for boilers, feed water arrangements, etc., in a gas turbine power station. Consequently, it occupies a much smaller space than a thermal power plant with a similar generating capacity.
- Standby losses are not present in gas turbine power plants.
- Because gas turbine power plants do not require a condenser, they require less water than thermal power plants.
- It is also important to note that the maintenance costs are quite low.
- Gas turbines are much simpler to construct and operate than steam turbines