DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: Mech/Chem/Petro/Civil **Sem.:- I**

Subject with Subject Code:- Energy & Environmental Engineering (CHE106)
Marks: 20

Date:- 5 October 2017 **Time:- 1 Hr.**

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Instructions:- 1. Figures to the right indicate full marks
2. Clearly mention the main question number along with the sub questions.

(Marks)

Q.No.1 Define the following: **(3 X 2 = 06)**

a) Principle of MHD Generator

An MHD generator is a device for converting heat energy of a fuel or kinetic energy directly into electrical energy without conventional electric generator. In MHD generator, the solid conductors are replaced by a gaseous conductor, an ionized gas. If such a gas is passed at a high velocity through a powerful magnetic field, a current is generated and can be extracted by placing electrodes in suitable position in the stream.

b) Anaerobic digestion of biomass

Anaerobic digestion is a biological process that produces a gas principally composed of methane (CH_4) and carbon dioxide (CO_2) otherwise known as biogas. Organic waste such as livestock manure and various types of bacteria are put in an airtight container called digester so the process could occur.

c) Fuel cell

A fuel cell is a device that produces electricity through a chemical reaction between a source fuel and an oxidant. The source fuel could be almost anything that can be oxidized, including hydrogen, methane, propane, methanol, diesel fuel or gasoline. The only byproducts are water and a small amount of nitrous oxide if air is used as the oxidizer.

Q.No.2 Attempt any one of the following: **(6 X 1 = 06)**

a) What is the present status of Nuclear energy in India and what are its future prospects?

Nuclear power is the fourth-largest source of electricity in India after thermal, hydroelectric and renewable sources of electricity.[1] As of 2016, India has 22 nuclear reactors in operation in 8 nuclear power plants, having an installed capacity of 6780 MW[2][3] and producing a total of 30,292.91GWh of electricity while 6 more reactors are under construction and are expected to generate an additional 4,300 MW.

b) Enumerate at least five applications of solar PV cell energy. Discuss in detail any one of them with a neat sketch.

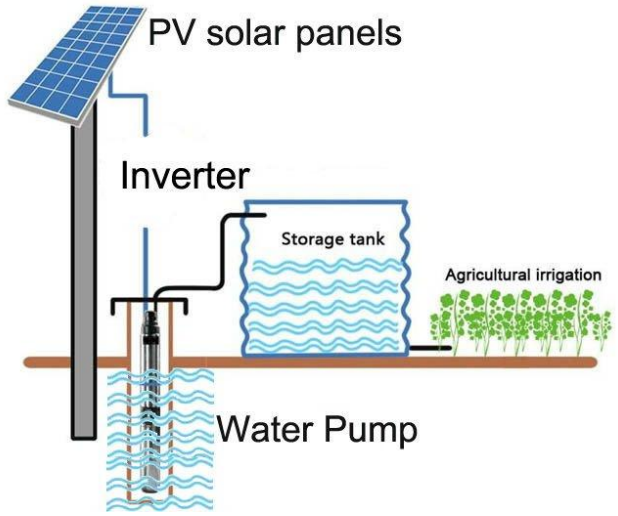
Applications of PV solar cell are-

- Grid interactive PV power generation
- Water pumping for irrigation
- Lighting

-Medical Refrigeration

-Village power

Solar power WATER PUMPING



A solar-powered pump is a normal pump with an electric motor that uses electricity generated from an on-site solar panel. Using the solar panel, solar energy is converted to direct-current (DC) electricity. Most solar-powered pumps require a DC motor to operate since it offers simpler and more efficient motor systems rather than using an alternating-current (AC) pump that is more complex and costly. During hot days, solar-powered water pumps work best because more electricity is generated during sunny days and cattle also need more water when the environment is hot. The components of a solar-powered water pump may depend whether it is attached to a direct-drive system or to a battery-operated system. In direct drive system, solar panel converts solar energy to direct current that powers the DC motor pump which allows water to be transferred from source to water storage. As for the batter-operated system, the solar panel converts solar energy to direct

current which is stored in the battery. The battery supplies current to the DC motor which drives pump to suction water from source to storage area.

Q.No. 3. Attempt any two of the following (2 X 4 = 08)

a) Identify the power plants for the following places.

i) Kaiga in Karnataka - Nuclear Power Plant
ii) Charanka in Gujarat -Solar power plant
iii) Jaisalmer in Rajasthan - Wind Farm
iv) Unai in Maharashtra - Geothermal Power

b) Compare the relative characteristics of HAWT and VAWT in wind power.

Item	**Characteristics of HAWTs**	**Characteristics of VAWTs**
Power generation efficiency	50-60%	Above 70%
Electromagnetic interference	Yes	No
Steering mechanism of the wind	Yes	No
Gear box	Yes above 10 KW	No
Blade rotation space	Quite large	Quite small
Wind resistance c apability	weak	Strong
Noise	5-60dB	0-10 dB
Effect on human being	Dizziness	No effect
Failure rate	High	Low
Maintenance	Complicated	Convenience
Rotating speed	High	Low
Effect on birds	Great	Small
Power Curve	Depressed	Full

c) Explain the working principle of Gas turbine power plant with a neat sketch.

Gas turbine power plant

The schematic arrangement of a gas turbine power plant is shown in Figure above. The main components of the plant are:

1. **Compressor**
   The compressor used in the plant is generally of rotator type. The air at atmospheric pressure is drawn by the compressor via the filter which removes the dust from air.The

rotator blades of the compressor push the air between stationary blades to raise its pressure.Thus air at high pressure is available at the output of the compressor.

2. **Generator**
   A generator is a device which recovers heat from the exhaust gases of the turbine. The exhaust is passed through the regenerator before wasting to atmosphere. A regenerator consists of a nest of tubes contained in a shell. The compressed air from the compressor passes through the tubes on its way to the combustion chamber. In this way, compressed air is heated by the hot exhaust gases.
3. **Combustion chamber**
   The air at high pressure from the compressor is led to the combustion chamber via the regenerator. In the combustion chamber, heat is added to the air by burning oil. The oil is injected through the burner into the chamber at high pressure to ensure atomization of oil and its thorough mixing with air. The result is that the chamber attains a very high temperature (about 3000ºF).The combustion gases are suitably cooled to 1300ºF to 1500ºF and then delivered to the gas turbine.
4. **Gas turbine**
   The products of combustion consisting of a mixture of gases at high temperature and pressure are passed to the gas turbine. These gases in passing over the turbine blades expand and thus do the mechanical work. The temperature of the exhaust gases from the turbine is about 900F.