DIPLOMAEXAMINATIONINENGINEERING/TECHNOLOGY /MANAGEMENT/COMMERCIALPRACTICE, NOVEMBER– 2024

CIVIL EENGINEERING

Construction management and safety engineering-ANSWER KEY

PART-A

. (9x1=9Marks)

1.	Renewable sources of energy are available plentiful in nature and are sustainable. These resources of energy can be naturally replenished and are safe for the environment	1	1
2.	Cogeneration or combined heat and power (CHP) is the use of a heat engine or power station to generate electricity and useful heat at the same time	1	1
3.	Solar radiation is the energy emitted by the Sun, which is sent in all directions through space as electromagnetic waves. Emitted by the surface of the Sun, this energy influences atmospheric and climatological processes.	1	1
4.	Solar collectors are of two types **1.** Non concentrating collector **2.** Concentrating collector	.5X2	1
5.	• Analysis of input • Reuse and recycling of waste • Energy education • Conservative technique and energy audit	.5X2	1
6.	Combustion is the process by which, the organic matter is burnt in the presence of oxygen which generates heat. Due to this heat water is boiled, steam is produced, turbine is turned and electricity is generated.	1	1
7.	1. Horizontal Axis turbines 2. Vertical Axis wind turbines	.5X2	1
8.	Geothermal energy is thermal energy extracted from the Earth's crust	.5X2	
9.	**MagnetoHydroDynamic**		

PART-B

(8x3=24Marks)

1.	• Natural gas • Coal • Petroleum • Nuclear energy • Hydrocarbon gas liquids.	.5X6	3
2.	• Walk-through Energy Audits • Target Energy Audits • Detailed Energy Audits	3	3

<table>
<tr><td>3.</td><td colspan="2">Advantages of Wind Energy

• Wind Energy is an inexhaustible source of energy and is virtually a limitless resource.
• Energy is generated without polluting environment.
• This source of energy has tremendous potential to generate energy on large scale.
• Like solar energy and hydropower, wind power taps a natural physical resource

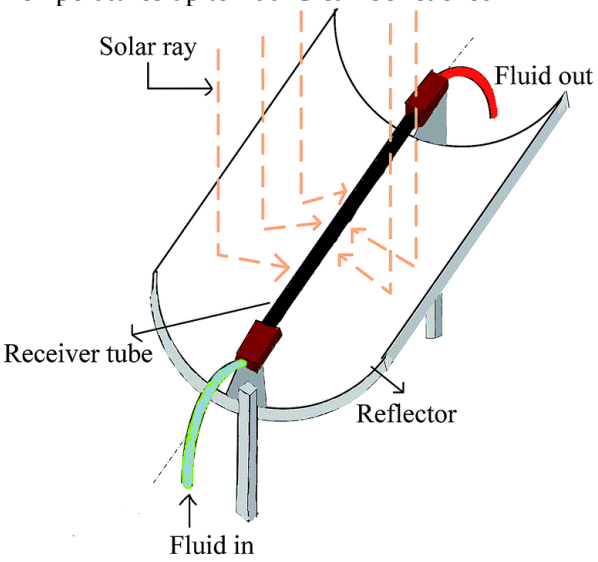
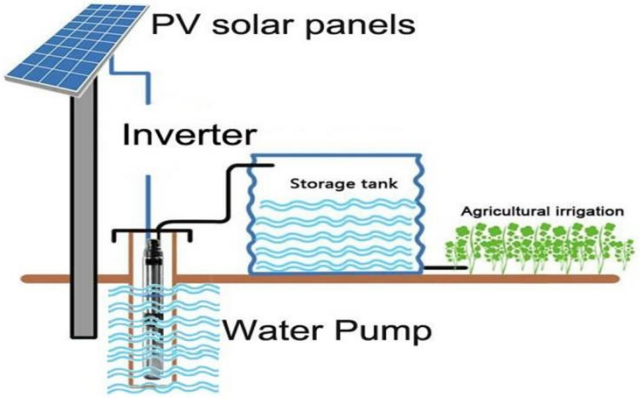
Disadvantages of Wind Energy

• Wind energy requires expensive storage during peak production time.
• There is visual and aesthetic impact on region.
• It is unreliable energy source as winds are uncertain and unpredictable.
• Requires large open areas for setting up wind farms.
• Wind energy can be harnessed only in those areas where wind is strong</td><td>.5X6</td><td>3</td></tr>
<tr><td>4.</td><td>Horizontal axis</td><td>Vertical axis</td><td>.5X6</td><td>3</td></tr>
<tr><td></td><td>Axis of rotation parallel to the ground</td><td>Axis of rotation perpendicular to the ground</td><td></td><td></td></tr>
<tr><td></td><td>Wind turbine works only for specific wind direction</td><td>Wind turbine works in all wind direction</td><td></td><td></td></tr>
<tr><td></td><td>More efficiency</td><td>Efficiency is less</td><td></td><td></td></tr>
<tr><td></td><td>More ground area needed</td><td>Less area is needed</td><td></td><td></td></tr>
<tr><td></td><td>Can be located in remote area due to large area required</td><td>Can be installed in urban area</td><td></td><td></td></tr>
<tr><td></td><td>Height is height</td><td>Height is less</td><td></td><td></td></tr>
<tr><td></td><td>Power transmission cost is increase</td><td>Power transmission cost is less</td><td></td><td></td></tr>
<tr><td>5.</td><td colspan="2">• Energy management is the set of actions and processes aimed at optimizing energy consumption in order to rationalize and reduce costs without affecting consumers.
• Energy management involves the planning of energy production and consumption.</td><td>1X3</td><td>3</td></tr>
</table>

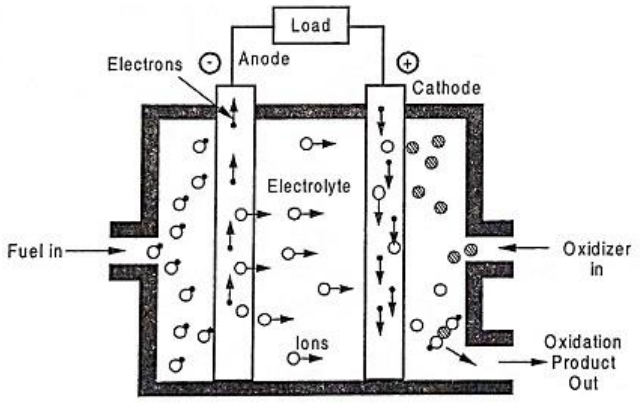
	• Proactive and systematic monitoring • Control and optimization of an organization's energy consumption to conserve use and decrease energy costs. • Energy management includes minor actions such as monitoring monthly energy bills and upgrading to energy-saving light bulbs.		
6.	• Used when more speed is required • When wind pressure over the surface of the rotor blade creates a low pressure and high-pressure area • This pressure difference produces two forces, lift force and drag force • The resultant of these two forces known as aerodynamic force cause the rotation of blades • The blades are made of lightweight materials such as fiberglass or reinforced plastic	.5X6	3
7.	• Declination • Hour angle • Altitude angle • Incident angle • Zenith angle • Solar azimuth angle	.5X6	3
8.	• Food dehydration • Milk pasteurizing • Gold mining • Heat buildings • Geot • hermal Power plant	1X3	3
9.	MHD power generation relies on the interaction between a conducting fluid (such as a plasma or a conducting gas) and a magnetic field. When a conducting fluid moves through a magnetic field, it induces an electric current perpendicular to both the fluid flow and the magnetic field.	1X3	3
10.	• Space heating and cooling • Solar distillation • Solar cooking and furnace • Solar pumping • Green house • Agricultural and industrial process heat	.5X6	3

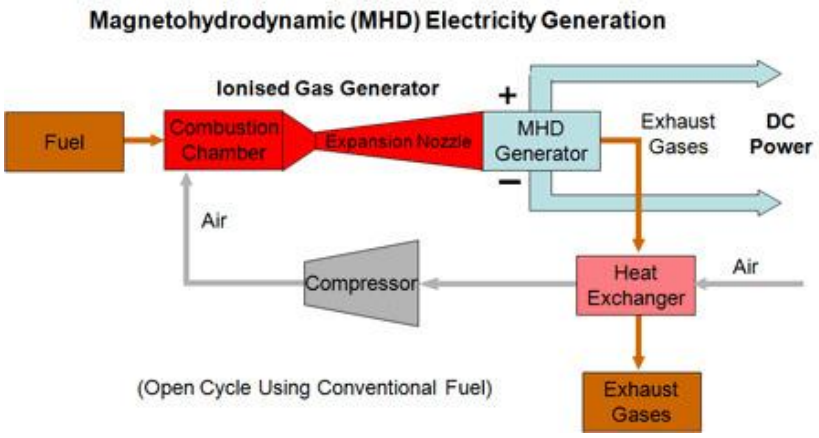
PART-C **(6x7=42Marks)**

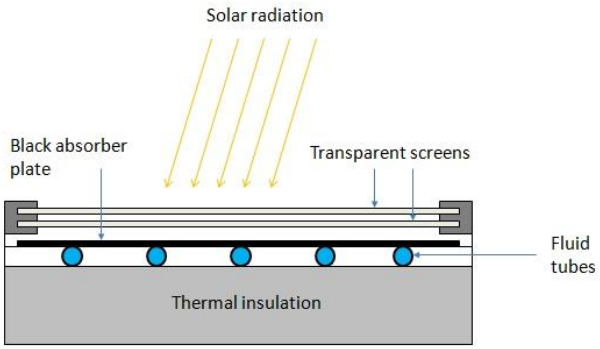
IV	• Install CFL Lights • Lower the Room Temperature • Use Maximum Daylight • Get Energy Audit Done • Use Energy Efficient Appliances • Drive Less and Walk More • Switch Off Appliances When Not in Use • Plant Shady Landscaping • Buying a Programmable Thermostat is the Best Decision to Make • Motion Detectors are a Real Saviour • Closing Doors is the Key to Conserving Energy • Air-dry dishes and clothes • Turn your refrigerator down • Install windows for daylight and air circulation	7	7
III.	**OR** Renewable sources of energy are available plentiful in nature and are sustainable. These resources of energy can be naturally replenished and are safe for the environment. Examples of renewable sources of energy are: • Solar energy • Geothermal energy • Wind energy • Biomass • Hydropower • Marine energy A non-renewable source is a natural resource that is found underneath the earth. These type of energy resources do not replenish at the same speed at which it is used. They take millions of years to replenish. The main examples of non-renewable resources are coal, oil and natural gas. Examples of non-renewable sources of energy are: • Natural gas • Coal • Petroleum • Nuclear energy • Hydrocarbon gas liquids.	7	7

V.	• Reflector is in the form of a trough with parabolic cross section • A parabolic trough concentrates incoming solar radiation onto a line running along the length of the Trough (reflector). • A tube (receiver) carrying heat transfer fluid is placed along this line, absorbing concentrated solar radiation and heating the fluid inside • Temperatures up to 400°C can be reached  	3.5+3.5	7
	OR		
VI.	A solar-powered pump is a pump running on electricity generated by photovoltaic panels Solar water pumps are often used in remote areas where the cost of running traditional water piping is cost prohibitive or you just want to provide water to an off-grid home. Solar water pumping systems are also used to pump water for livestock and crop irrigation  	3.5+3.5	7

VII.	Criterion for selection of sites • The wind energy conversion machine should be located in areas where the winds are strong and persistent. An ideal site will be one where a smooth steady wind flows all the time. The minimum average wind speed at which WECS works is about (3.5 - 4.5m). • Site for WECS should be at high altitude because, the winds tend to have higher velocities at higher altitude • The land cost should be low and the ground conditions at the site should be suitable for installation. • The site selected should be near to the users of generated electrical energy. • At the site, the environmental conditions should not affect the aero turbine blades and electrical apparatus. • The site should be near to the transport facilities such as road and railway facilities. • Maintenance facilities available	1X7	7
VIII.	**OR** Classification of wind turbines Wind energy conversion devices can be broadly categorized into two types according to their axis alignment. 1. Horizontal Axis turbines 2. Vertical Axis wind turbines **Horizontal Axis turbines** Axis of rotation parallel to the ground a. Dutch type grain grinding or sail type b. Multi Blade type c. High speed propeller type **Vertical Axis wind turbines** Axis of rotation perpendicular to the ground a. Savonius type b. Darrieus type c. Giromill or H-Type	3.5+3.5	7

IX	Fuel cells are electrochemical devices that convert the chemical energy of a fuel directly into electricity. They operate similarly to batteries but can produce electricity continuously as long as fuel and oxidant are supplied **Principle of Fuel Cells** Fuel cells consist of an anode, a cathode, and an electrolyte. Fuel (such as hydrogen, methanol, or natural gas) is fed into the anode, while an oxidant (usually oxygen from the air) is supplied to the cathode. The fuel undergoes electrochemical reactions within the cell, generating electricity, water, and heat as byproducts.  *Fig:4.57 Fuel Cell*	7	7
X.	**OR** Magnetohydrodynamic (MHD) power generation is a method of generating electricity directly from ionized gases (plasma) or conducting fluids (like seawater) passing through a magnetic field and an electric field. **Principle of MHD** MHD power generation relies on the interaction between a conducting fluid (such as a plasma or a conducting gas) and a magnetic field. When a conducting fluid moves through a magnetic field, it induces an electric current perpendicular to both the fluid flow and the magnetic field. **Working of MagnetoHydroDynamic (MHD) power generation** • **Fluid Flow:** The process starts with a conductive fluid being forced to flow through a duct or channel. This fluid can be heated to high temperatures to increase its conductivity. The fluid can be sourced from various systems such as nuclear reactors, coal combustion, or natural gas combustion. • **Magnetic Field Application:** A strong magnetic field is applied perpendicular to the direction of fluid flow. This magnetic field can be generated using powerful electromagnets or permanent magnets. The magnetic field exerts a force on the charged particles within the fluid, such as ions and electrons. • **Electromagnetic Induction:** As the conductive fluid moves	7	7

	through the magnetic field, it experiences a force known as the Lorentz force, which induces (lead) an electric current perpendicular to both the fluid flow and the magnetic field. This phenomenon is based on the principles of electromagnetic induction, as described by Faraday's law. **Electricity Generation:** The induced electric current can be collected using electrodes placed within the fluid flow or along the duct walls. This electric current can then be harnessed and utilized to generate electricity. The generated electricity can be used to power various devices or fed into an electrical grid for distribution.  		
XI.	**Geothermal extraction** • **Dry rock system** • **Wet rock system** **Dry rock system** It is an abundant source of geothermal energy available for use, a vast store of thermal energy is contained within hot but essentially dry they found almost everywhere deep beneath the earth's crust. Extracting energy from dry, hot rocks would be possible by drilling holes into the hot rock mass and creating cracks and cavities by one of the method used in conjunction • Oil and gas well stimulation, • Blasting conventional • Nuclear explosive would generate opening in the rock **Process** • Well drilled 4-6 km into crust • Water pump into the formation • Water flow through the natural opening to pick up the steam • Hot water / steam return to the surface and direct use • Steam used to generate electricity **Wet rock system** • Wet rock geothermal energy is also known as hydrothermal system • Involves exploiting naturally occurring underground reservoir of the hot water or stream • Wet rock systems tap into naturally occurring hot water or steam reservoirs **Wet rock system** • Wet rock geothermal energy is also known as hydrothermal system • Involves exploiting naturally occurring underground reservoir	7	7

	of the hot water or stream • Wet rock systems tap into naturally occurring hot water or steam reservoirs **Process** • Well drilled into crust • Water pump into the formation • Water flow through the natural opening to pick up the steam • Hot water / steam return to the surface and direct use • Steam used to generate electricity		
XII	 • It consists basically of an insulated metal box with a glazed glass cover and a dark-colored absorber plate and a pipe for fluid passage • Heat from the sun strikes the absorber plate and is transferred to a fluid that circulates through the collector in tubes • The glass front cover must be sealed so that heat does not escape, and dirt, insects or humidity do not get into the collector itself • The back and sides of the metal box are insulated to avoid heat loss • water- heating systems in residential, commercial and industrial	7	7
XIII	Energy management techniques • Analysis of input • Reuse and recycling of waste • Energy education • Conservative technique and energy audit **Analysis of input** • In general, energy input–output typically determines the total amount of energy required to deliver a product to final demand **Reuse and recycling of waste** • Converting industrial waste energy streams into heat and power with on-site generation plants. • Building CHP facilities near energy users to enable recycling of wasted energy from the production. of electricity to displace boiler fuel. **Energy education** Energy education is an important tool to develop various energy technologies, information with new energy resources and various opportunities are available in meeting energy requirements.	7	7

	Conservative technique and energy audit • Energy conservation is the decision and practice of using less energy • Energy audit is an inspection, survey and analysis of energy flow for energy conservation in a building • Energy audit is a process to determine when, where, why and how energy is used in a plant or building		
XIV	**OR** Biodiesel Biodiesel is a renewable, biodegradable fuel manufactured domestically from vegetable oils, animal fats, or recycled restaurant grease. Biodiesel meets both the biomass-based diesel and overall advanced biofuel requirement of the Renewable Fuel Standard. Renewable diesel is distinct from biodiesel. Biodiesel is a liquid fuel often referred to as pure, or neat biodiesel in its unblended form. Like petroleum diesel, biodiesel is used to fuel compression-ignition engines. Biodiesel production • Biodiesel is produced from vegetable oils, yellow grease, used cooking oils, or animal fats. • The fuel is produced by transesterification—a process that converts fats and oils into biodiesel and glycerin (a coproduct). • Approximately 100 pounds of oil or fat are reacted with 10 pounds of a short-chain alcohol (usually methanol) in the presence of a catalyst (usually sodium hydroxide [NaOH] or potassium hydroxide [KOH]) to form 100 pounds of biodiesel and 10 pounds of glycerin (or glycerol). • Glycerin, a co-product, is a sugar commonly used in the manufacture of pharmaceuticals and cosmetics. Applications of Biodiesel • Fuel compression • Ignition engines • Fuel filters • Heating oils • Oil spill cleanups • Biodiesel electricity generators	7	7