Chapter 1: Overview of Electrical Engineering

1 mark questions

1	**Define PV module** Ans: A unit comprised of several PV cells
2	**List any four electrical engineering marvels** Ans: i. Electricity serves as a faithful domestic servant in daily life. ii. In summer season electric fans, air conditioning plants are used to provide us with cool atmosphere iii. In winter, heating plants are used to keep the room warm. iv. Electric bell, press and stove are things of every-day use.
3	**Expand MPPT** Ans: Maximum Power Point Tracking
4	**Define efficiency of wind power conversion** Ans: Wind power efficiency conversion can be defined as the ratio of useful output power to wind power input (usually it is 59%) $\eta = \frac{\text{Useful output power}}{\text{Wind power input}}$

2 mark questions:

1	**List the factors on which the wind power is dependent** Ans: The wind power is dependent on following factors (a)Area, A (b) Air density ρ (c) Wind velocity V^3 Expression for wind power is given by, $\boldsymbol{P = \frac{1}{2}\rho A V^3}$ **……..(1)** Where, P is the power in watts A is the area in sq.m. and $A = \frac{\pi}{4}D^2$, D is the diameter in meter. ρ is the air density in kg/m^3 V is the wind velocity in m/s ***Note : Numericals will be on this expression (1)

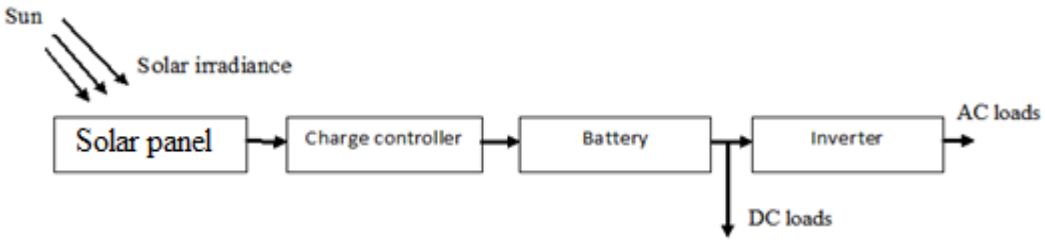
2	**List the components of wind energy conversion system or components of wind turbine system** Ans: i. Hub ii. Blades iii. Main shaft iv. Gear box v. Generator vi. Housing vii. Tower viii. High speed shaft.
3	**List the components of solar photovoltaic system** Ans : i. Solar panels ii. Charge controller. iii. Battery iv. Inverter v. DC load vi. AC load
4	**List any two electrical engineering marvels and explain why according to you it is electrical engineering marvel**

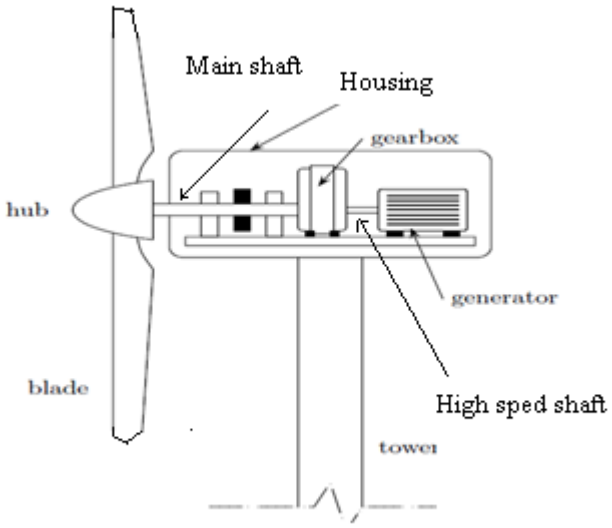
4 mark questions

1	Expression for wind power is given by, $$\boldsymbol{P = \frac{1}{2}\rho A V^3}$$ Where, P is the power in watts A is the area in sq.m. and A = $\frac{\pi}{4}D^2$, D is the diameter in meter. ρ is the air density in kg/m^3 V is the wind velocity in m/s Note : Numerical examples will be on this expression Examples: **i. Calculate the power in the wind if wind velocity is 10m/s for density of 1.225kg/m^3 and blade diameter of 200cm** Solution: **A = $\frac{\pi}{4}D^2$ = 3.141 $sq.m$ (conversion of diameter from cm to meter 100cm=1m Therefore 200cm = 2m)** **$P = \frac{1}{2}\rho A V^3$ = 1924.22 Watts** ***Note : Use these formulas to substitute the above values and solve as shown

	ii.	**Calculate the wind velocity if the power is 8184 kW, density is 1.226 kg/m^3 and blade diameter of 120m** **A =** $\frac{\pi}{4}D^2$ **= 11309.73** $sq.m$ $P = \frac{1}{2}\rho A V^3$ $V^3 = \frac{(P*2)}{\rho A} = \frac{(8184\,k\ *\ 2)}{1.226\ *11309.73}$ **=1180.4** **V =10.568 m/s**

6 mark questions

1	**Explain the components involved in a PV system with neat schematic diagram.** Ans:  i. **Solar panels:** The solar panels (photovoltaic or PV modules) convert daylight to electricity. A number of modules are connected together to increase the electrical power that can be generated. The entire bank of modules may be referred to as the solar array. ii. **Charge controller:** A charge controller limits the rate at which electric current is added to or drawn from electric batteries. iii. **Battery:** Batteries store energy being produced by a given generating source, and when this source is unavailable this energy can be used by the load. iv. **Inverter:** The basic function of the inverter in a photovoltaic solar power system array is to convert the DC electricity generated by the solar panels into standard AC power. Any photovoltaic solar power system that supplies power to an AC load must use an inverter. v. **DC load:** LED lightning system vi. **AC load:** Domestic appliances.

2	**Explain horizontal axis wind turbine with neat schematic diagram.** Ans:  **i.** **Hub:** Supports the blade. **ii.** **Blades**: Converts the kinetic energy in the wind to mechanical power **iii.** **Main shaft**: Houses blades, gear box and generator. iv. **Gear box**: Increases the low rpm (rotation per minute) of the shaft to higher rpm required by the generator. v. **Generator**: Converts mechanical input to electrical output. vi. **Housing**: Houses all of the generating components in a wind turbine. vii. **Tower**: Supports entire structure (from blades to generator). It is usually few 100 feet tall. **viii.** **High speed shaft**: High speed shaft attain the speed for driving the generators.
3	**Explain the impact of electrical energy on national economy.** Ans: i. Electrical engineering industry encompasses a wide area of activities from lighting to mobile communications and that is why this industry has a huge capital earning potentiality, which can strengthen the economy of a country. ii. Electrical engineering industry can reduce the growing world economies from the vulnerability to energy shortages. iii. Clean electrical energy can be an alternative source of power, which we normally acquire from hydrocarbons, like coal, petroleum products etc. and this way it is gradually becoming a booming industry.

4	**Explain atleast six measures (6 marks) four measures (4marks) to conserve energy** Ans: i. Turn off the lights when not in use. ii. Take advantage of daylight by using • Light- colored loose-weave curtains on your windows to allow daylight to penetrate the room. • Also, decorate with lighter colors that reflect daylight. iii. De-dust lighting fixtures to maintain illumination. • Compact fluorescent bulbs are four times more energy efficient than incandescent bulbs which provides the same lighting. • Do not switch on the power when TV and Audio Systems are not in use. i.e. idle operation leads to an energy loss of 10 watts/device. • If your computer must be left on, • turn off the monitor; • This device alone uses more than half the system's energy. • Battery chargers, such as those for • Laptops, cell phones and digital cameras, draw power whenever they are plugged in and are very inefficient. Pull the plug and save. • Screen savers save computer screens, not energy. • Start-ups and shutdowns do not use any extra energy, nor are they hard on your computer components. • In fact, shutting computers down when you are finished using them actually reduces system wear and saves energy • In washing machines use timer facility to save energy. • Plant trees or shrubs to shade • Air-conditioning units but not to block the airflow. • A unit operating in the shade uses as much as 10% less electricity than the same one operating in the sun