

RENEWABLE ENERGY POWER PLANTS*Time Allowed: 2.5 Hours**Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.

Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): $2 \times 10 = 20$
- The ultimate source of energy in our Earth is
 - Coal Energy
 - Solar Energy
 - Wind Energy
 - Hydro Energy
 - The Francis turbine is generally suitable to operate under
 - 100 m to 80 m net head with very low flow of water
 - 30 m to 90 m net head with medium water flow rate
 - 2 m to 10 m net head with high flow rate of water
 - More than 150 m net head and medium flow rate of water
 - From the following, the **ONLY** horizontal axis wind turbine is
 - Darreis rotor wind turbine
 - H-rotor type wind turbine
 - Dutch wind mill
 - Savonius rotor wind turbine
 - Solar cell works on the principle of
 - Photo Electric Effect
 - Photo-Voltaic Effect
 - Photosynthesis
 - Crompton Effect
 - Solar Pyranometer measures _____ radiation received on Earth's surface.
 - Global
 - Direct
 - Diffused
 - Cannot be determined
 - Which kind of control is most suitable for aligning a horizontal axis wind turbine along the direction of wind flow?
 - Mechanical Brakes
 - Pitch control
 - Electrical control
 - Yaw control
 - The Pelton wheel turbine is a
 - High head impulse turbine
 - Low head radial flow reaction turbine
 - Medium head mixed flow impulse turbine
 - High head radial flow reaction turbine

- viii. The maximum power of a photo-voltaic cell is obtained in which point of its i-v curve?
- MPP
 - Open Circuit Point
 - Short Circuit Point
 - Depends upon the intensity and frequency of incident light
- ix. The bioethanol is rectified to eliminate following -
- Sugar
 - Impurities
 - Enzymes
 - Yeast
- x. Main components of biogas are-
- CH₄ and H₂ only
 - CH₄, N₂ and H₂S
 - N₂, CO₂ and H₂S only
 - CH₄, CO₂, H₂S and N₂ only
- xi. The most commonly used electric machine for electricity generation from wind energy is
- Synchronous Machine
 - Induction machine
 - DC series machine
 - DC compound machine
- xii. Thin Film solar cell technology uses
- Mono-crystalline Silicon solar cell
 - Poly-crystalline Silicon solar cell
 - Amorphous Silicon-solar cell
 - All of these
- xiii. The maximum speed of wind up to which a wind turbine can be operated safely is around
- 15Km/hr to 17Km/hr
 - 23Km/hr to 25Km/hr
 - 10Km/hr to 12Km/hr
 - 33Km/hr or more
- xiv. The advantage(s) offered by a micro hydro power plant _____
- It eliminates the construction of large dam
 - Aquatic biodiversity is preserved specially in down stream
 - It can be constructed even in remote locations like mountainous region
 - All of the above are equally true
- xv. When wind velocity increases, power contained in wind proportionately _____.
- decreases linearly with wind velocity
 - increases in cubic power of wind velocity
 - increases in forth power of wind velocity
 - decreases in cubic power of wind velocity

GROUP-B
Answer any Five (05) questions.

2. a) Explain the importance of renewable energy in the production of electricity.
b) Describe the present challenges faced in production of electricity from renewable energy sources. 4+4=8
3. a) Explain the working of an On-grid photo-voltaic power plant with the help of a schematic diagram.
b) Write the name of the two major components present in a standalone solar photovoltaic power plant.
c) Classify different Solar Thermal Collectors. 5+1+2=8
4. a) Draw the layout of wind energy power plant that utilizes permanent magnet synchronous machine as electric generator and explain the working of this system.
b) Briefly explain why DFIG is used mostly in grid-connected wind turbines. 5+3=8
5. a) Draw the layout of floating dome type biogas generator and explain its working.
b) What is the advantage of this system over fixed dome type plants?
c) Name two solid fuels and two liquid fuels for Biomass Power Plant. 4+2+2=8
6. a) Compare between horizontal axis and vertical axis wind turbine.
b) Define Tip Speed ratio.
c) Explain the reason why large wind farms are commonly situated along the coastline of India.
<https://www.wbscteonline.com> 5+1+2=8
7. a) Draw I vs V & P vs V curve of a solar cell and mention the significance of the important points on the characteristics.
b) A solar cell measures 150mm by 150mm. It is exposed to a solar radiation of 1000W/m^2 . The open circuit voltage is 0.68V. The efficiency of the cell is 15% and fill factor is 0.87. Calculate- i) Maximum output power, ii) short circuit current
c) Name a type of non-silicon based Photovoltaic cell. 4+3+1=8
8. Write short note on (any Two) – i) Solar Pyranometer, ii) Bio-diesel, iii) Pyrolysis based biomass Power Plant, iv) Betz Limit 4+4=8
9. a) Draw and explain the construction and working of Francis turbine
b) Classify hydro power plants based on i) capacity iii) available head. 5+3=8