

Code No: R204102B

R20

SET - 1

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM**  
**IV B. Tech I Semester Advanced Supplementary Examinations March 2025**  
**RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES**  
(ELECTRICAL & ELECTRONICS ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**  
All Questions Carry Equal Marks

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**UNIT-I**

1. a) Explain the advantages and applications of renewable energy sources in distributed generation systems. [7M]  
b) Describe the key aerodynamic and mechanical aspects of wind machine design. How do these factors influence the efficiency of wind energy conversion? [7M]  
(OR)
2. a) Discuss the various methods for estimating wind energy potential and explain how wind maps help in the site selection of wind farms. [7M]  
b) Illustrate how wind velocity measurements are performed and the instrumentation used? [7M]

**UNIT-II**

3. a) Explain the relationship between wind speed, power, and energy in wind systems. Derive the expression for power extraction from wind. [7M]  
b) Define Tip Speed Ratio (TSR). How does TSR affect the performance of wind turbines? Discuss the methods used for controlling pitch and speed in wind energy systems. [7M]  
(OR)
4. a) Describe the differences between fixed-speed and variable-speed wind turbine control systems. Discuss the advantages of each type in terms of power optimization. [7M]  
b) Explain the operation and control of self-excited and doubly-fed induction generators in wind energy conversion systems. [7M]

**UNIT-III**

5. a) Discuss the technological advancements in photovoltaic systems. What are the key components of solar energy systems? [7M]  
b) Derive the current-voltage and power-voltage characteristics of a solar cell. How do temperature variations affect these characteristics? [7M]  
(OR)
6. a) Explain the concept of Maximum Power Point Tracking (MPPT) and discuss the techniques used to track maximum power in a photovoltaic system. [7M]  
b) What are the challenges associated with partial shading in solar systems? How do MPPT techniques address these challenges? [7M]

**UNIT-IV**

7. a) Discuss the water power estimates and the use of hydrographs in hydropower generation. [7M]  
b) Explain the design principles behind hydraulic turbines, including their characteristics and part-load performance. [7M]

(OR)

8. a) Describe the components and design of a hydroelectric plant, including turbines, draft tubes, and penstocks. [7M]  
b) Provide a brief overview of other renewable energy sources, such as tidal, geothermal, and gas-based energy systems. Discuss their potential and applications. [7M]

**UNIT-V**

9. a) Explain the need for hybrid systems that combine various renewable energy sources. Discuss the role of energy storage in these systems. [7M]  
b) Describe the role of power electronics in the interface of distributed generation systems with the grid. How do these systems control frequency and voltage in grid-connected and stand-alone modes? [7M]

(OR)

10. a) Describe the role of power electronics in the interface of distributed generation systems with the grid. How do these systems control frequency and voltage in grid-connected and stand-alone modes? [7M]  
b) What are the key challenges in the integration of distributed generation systems into the grid? Discuss potential solutions for efficient integration. [7M]

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