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Question Paper Code : 91024

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fifth/Sixth/Seventh/Eighth Semester

Electrical and Electronics Engineering

EE 3033 — HYBRID ENERGY TECHNOLOGY

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the characteristics of solar photovoltaic cells.
2. List any two renewable energy sources used in hybrid systems.
3. Define the role of reference theory in WECS.
4. Compare synchronous and induction generators in WECS.
5. Write in short about battery sizing.
6. Write about the process of array sizing.
7. Mention the functions of bi-directional converters.
8. List the merits of matrix converters.
9. Define micro-hydel system.
10. How biomass-diesel-fuel cell systems work?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the environmental impacts of renewable energy generation in present scenario. (8)
(ii) Summarize the working principle of fuel cells in hybrid systems. (5)

Or

- (b) (i) Illustrate the role of ocean and geyser energy in hybrid energy generation. (8)
(ii) Distinguish between solar-wind and wind-biomass hybrid energy systems. (5)

12. (a) Explain the construction and operation of a Squirrel Cage Induction Generator (SCIG) with wind power application.

Or

- (b) Illustrate how induction generators convert wind energy into electrical energy with suitable sketches.

13. (a) Analyze the performance differences between boost and buck-boost converters in PV systems.

Or

- (b) Compare standalone and grid-connected PV systems based on performance and their process parameters.

14. (a) (i) Design a suitable converter scheme to integrate diesel generators and PV systems in a hybrid setup. (8)
(ii) Examine the limitations of power converters in large-scale hybrid systems. (5)

Or

- (b) (i) Analyze and interpret how converter choice impacts the efficiency of hybrid energy systems. (8)
(ii) Distinguish between controlled and uncontrolled rectifiers in AC-DC conversion. (5)

15. (a) Analyze the cost-benefit trade-offs involved in implementing hybrid energy systems. Also outline about financial factors influence system selection and design.

Or

- (b) Elaborate the performance analysis methods for different hybrid systems using an illustrative example.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Interpret the steps in implementing a hybrid energy solution combining micro-hydel and PV for a remote village.

Or

- (b) Analyze the performance differences between DFIG and PMSG machines used in wind energy conversion systems.
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