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Question Paper Code : 50982

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fifth/Sixth Semester

Electrical and Electronics Engineering

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EE 3014 — POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define fill factor of a solar cell.
2. Draw the ideal PV cell equivalent circuit.
3. Classify generators based on excitation.
4. Write the effect of injected emf in the rotor of an induction machine.
5. List the factors affecting the life of the battery.
6. List the parameters usually given in PV data sheets.
7. List the applications of uncontrolled rectifiers.
8. Compare matrix converter and back-to-back converter.
9. Write the demerits of wind-diesel hybrid energy system.
10. List the control algorithms for maximum power point tracking.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the following with respect to wind energy.
 - (i) Wind control systems. (6)
 - (ii) (power and torque) versus speed characteristics of wind turbine. (7)
- Or
- (b) Discuss the technology, construction, working, merits and demerits of Polymer Electrolyte Membrane fuel cells.

12. (a) With relevant expressions, discuss the bi-directional flow of power achieved in Doubly Fed Induction Generator AC-DC-AC converter.

Or

- (b) Explain the characteristic requirements of a small scale SCIG for effective electricity generation from wind energy.
13. (a) With the basic circuit and instantaneous output voltage waveform of step down DC-DC converter for purely resistive load prove that the average output voltage can be controlled by varying the switch duty ratio.

Or

- (b) With switch-on circuit, switch-off circuit and load current waveform of continuous conduction mode DC-DC step up converter derive for the relationship between output current and duty ratio.
14. (a) Explain the operation of current controllers used with grid interactive inverters.

Or

- (b) Explain the harmonic analysis of three phase AC voltage regulators using thyristor-diode switches.
15. (a) Discuss the relative merits and demerits of hybrid system in the case of wind PV system.

Or

- (b) Explain the various methods to analyze the maximum power point tracking.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Discuss in detail the technology available for PMSG in wind energy conversion system. (8)
(ii) Write a technical note on MPPT strategy. (7)

Or

- (b) (i) Explain the chemistry of biomass gasification process. (6)
(ii) Compare up, down and cross draught gasifiers with respect to efficiency, SPM and gas temperature. (9)