

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 81254

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth/Sixth/Seventh/Eighth Semester

Electrical and Electronics Engineering

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. What are the main environmental impacts of renewable energy generation?
2. How does hydrogen energy differ from biomass energy in terms of conversion principle?
3. Mention the advantages of Permanent Magnet Synchronous Generator (PMSG) in WECS.
4. State the concept of variable-speed operation in a Doubly Fed Induction Generator (DFIG).
5. Define "Maximum Power Point Tracking (MPPT)" in solar PV systems.
6. What are the main components of a stand-alone solar PV system?
7. Distinguish between boost and buck-boost converters
8. List the types of hybrid renewable energy systems.
9. Write any two applications of matrix converters.
10. State the need for grid integration of renewable energy systems.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss in detail, the classification of renewable energy sources with neat diagrams.

Or

- (b) Analyze the environmental impacts of large-scale renewable energy integration.
12. (a) With neat sketches, elaborate the construction and working of DFIG-based Wind Energy Conversion System.

Or

- (b) Elucidate the construction and working principle of a Squirrel Cage Induction Generator (SCIG). Illustrate with a neat diagram and discuss its application in wind energy systems.
13. (a) Compare and contrast stand-alone and grid-integrated solar PV systems with respect to structure, control strategy, and applications. Also discuss key grid connection issues including synchronization, islanding, and power quality.

Or

- (b) Draw the block diagram of a typical solar PV system and explain the function of each component, highlighting its role in energy conversion and power delivery.
14. (a) Illustrate the construction and operation of a three-phase AC voltage controller with the help of circuit diagrams and waveforms. Also state its major applications.

Or

- (b) Discuss in detail the working and control features of a grid-interactive inverter. Explain how it synchronizes with the grid and handles bidirectional power flow.
15. (a) What are the various types of hybrid renewable energy systems. Explain the working principle and integration approach of any two combinations.

Or

- (b) With the help of a block diagram, explain the configuration and operation of a Diesel-PV hybrid system. Discuss its advantages and challenges.

PART C — (1 × 15 = 15 marks)

16. (a) Using a neat block diagram, analyze the AC—DC—AC converter topology for a grid-connected wind energy system. Analyze the converter control and impact on power quality during grid disturbances.

Or

- (b) Summarize the importance of MPPT in solar PV systems and examine impact of temperature and irradiance variations on MPPT efficiency.
-

