

Reg. No. :

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

Question Paper Code : 81273

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 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 need for hybrid energy systems.
2. State the present installed capacity of solar and wind energy-based systems in India.
3. Express a matrix form for the abc/dq transformation in the analysis of electrical machines.
4. Write the advantages of DFIG with the reference to wind energy conversion system.
5. Write the significance of power converters in SPV system.
6. List the factors influencing on battery sizing.
7. Distinguish between grid interactive and grid feed inverters.
8. List the merits of matrix converters.
9. Write the factors which determine the choice of hybrid system.
10. Distinguish between isolated and grid interactive hybrid systems.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Discuss the positive and negative impacts of renewable energy-based power generation systems on the environment. State the mitigation strategies for negative impacts.

Or

- (b) Explain the operating principles and characteristics of hydrogen fuel cell.
12. (a) Explain the working principles and the torque-speed characteristics of Squirrel Cage Induction Generator (SCIG) and explain its suitability for wind power generation system.

Or

- (b) Describe the construction and working principle of Permanent Magnet Synchronous Generator and explain its suitability for wind power generation system.
13. (a) Draw a circuit topology of a buck-boost converter and explain its main parts. Also explain the operation of the converter under continuous conduction mode with relevant waveforms.

Or

- (b) With the help of block diagrams, explain the operations of standalone solar PV systems.
14. (a) Draw the circuit diagram of a PWM Current source inverter and explain its operation with relevant waveforms.

Or

- (b) Explain the different modes of operation of bidirectional converter with relevant diagram with reference to an application.
15. (a) Draw the schematic diagram of Diesel-PV hybrid system and explain its operation. Also discuss its advantages and limitations of this system.

Or

- (b) Discuss the salient features of Micro-hydel-PV hybrid system and also discuss the benefits and challenges of Micro hydel – PV system.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Make a case study on the present status of availability, installed capacity and future plan of Ocean energy, Biomass energy, Hydrogen energy at the national and international levels.

Or

- (b) Draw the block diagram of Wind-PV-Fuel-cell hybrid system and do performance and cost analysis.