

Register No : \_\_\_\_\_

**THE KAVERY ENGINEERING COLLEGE**  
(An Autonomous Institution)

**B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024**

*Sixth Semester*

*Electrical and Electronics Engineering*

**EE3033 – Hybrid Energy Technology**

*Regulations - 2021*

*Duration : 3 Hrs*

*Maximum : 100 Marks*

**PART – A (ANSWER ALL QUESTIONS) (Marks 10\*2=20)**

| <i>Q.No</i> | <i>Questions</i>                                                                      | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|---------------------------------------------------------------------------------------|------------|-----------|--------------|
| 1.          | What are the advantages of using grid-connected solar PV system?                      | RE         | 1         | 2            |
| 2.          | Define Betz limit.                                                                    | RE         | 1         | 2            |
| 3.          | Tell the advantages of wound rotor induction generator used in wind power generation. | RE         | 2         | 2            |
| 4.          | Name few permanent magnet materials used in designing PMSG.                           | RE         | 2         | 2            |
| 5.          | Draw the circuit diagram of buck-boost dc-dc converter.                               | RE         | 3         | 2            |
| 6.          | Summarize the factors involved in battery sizing.                                     | AP         | 3         | 2            |
| 7.          | What is ripple factor in rectification?                                               | RE         | 4         | 2            |
| 8.          | Name the types of bidirectional converters.                                           | RE         | 4         | 2            |
| 9.          | Define fill factor of solar cell.                                                     | RE         | 5         | 2            |
| 10.         | Name the membrane used in fuel cell.                                                  | RE         | 5         | 2            |

**PART – B (ANSWER ALL QUESTIONS) (Marks 5\*13 = 65)**

| <i>Q.No</i> | <i>Questions</i>                                                                                                                         | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 11.         | a i Construct the neat diagram explain the working principle of fuel cell.                                                               | AP         | 1         | 7            |
|             | ii Explain the concept of power generation using biomass.                                                                                | AP         | 1         | 6            |
|             | Or                                                                                                                                       |            |           |              |
| b           | Explain the impact of following renewable energy sources on environment.                                                                 | AP         | 1         | 13           |
|             | (i) Wave energy (ii) Wind energy                                                                                                         |            |           |              |
| 12.         | a Demonstrate in detail and working principle of Permanent Magnet Synchronous Generator (PMSG) with neat sketch.                         | UN         | 2         | 13           |
|             | Or                                                                                                                                       |            |           |              |
| b           | Explain the steady-state equivalent circuit model and performance characteristics of Squirrel Cage Induction Generator (SCIG) in detail. | UN         | 2         | 13           |
|             |                                                                                                                                          |            |           |              |
| 13.         | a Summarize the control strategy used in grid-interactive power converter system with neat diagram.                                      | UN         | 3         | 13           |
|             | Or                                                                                                                                       |            |           |              |
| b           | List any two power conditioning schemes used in solar PV system in detail.                                                               | UN         | 3         | 13           |
|             |                                                                                                                                          |            |           |              |

|     |   |                                                                                                                                       |    |   |    |
|-----|---|---------------------------------------------------------------------------------------------------------------------------------------|----|---|----|
| 14. | a | Apply the concept and operation of grid-interactive inverters. What are the advantages of using these inverters in grid-tied systems? | AP | 4 | 13 |
|     |   | Or                                                                                                                                    |    |   |    |
|     | b | Construct the circuit diagram of matrix converter with different mode of operation in detail.                                         | AP | 4 | 13 |
| 15. | a | Choose any three different configuration of hybrid renewable energy system in detail.                                                 | AP | 5 | 13 |
|     |   | Or                                                                                                                                    |    |   |    |
|     | b | Develop the Perturb and Observe (P&O) algorithm based MPPT of PV system with flow chart.                                              | AP | 5 | 13 |

*PART – C (Marks 1\*15 = 15)*

| <i>Q.No</i> |     | <i>Questions</i>                                                                                                                                                                                                                                | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 16.         | a i | Assume a horizontal axis wind turbine has a diameter of 6 m. when the wind speed unaffected by the turbine is 10 m/s, the turbine rotates at 300 rpm and produces 5 kW of mechanical power. find the tip-speed ratio and the power coefficient. | AN         | 5         | 12           |
|             | ii  | Solve an expression of power extracted from the wind turbine.                                                                                                                                                                                   | AP         | 5         | 3            |
|             |     | Or                                                                                                                                                                                                                                              |            |           |              |
|             | b i | Analyze the power electronic interface circuit, explain how grid integration is done for Doubly-fed induction generator (DFIG) based wind energy conversion system.                                                                             | AN         | 2         | 12           |
|             | ii  | Choose the need of grid integration of wind energy conversion system.                                                                                                                                                                           | AP         | 2         | 3            |