Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40996

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024

Fifth/Sixth/Seventh Semester

Electrical and Electronics Engineering

EE 3007 – SMART GRID

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the tasks involved for the roll out of smart grids in India?
2. How a smart grid can act as a self - healing grid?
3. List some of the protocols followed in AMI infrastructure.
4. Identify the role of PMU in smart grid.
5. What are the benefits of using WAMS in power system operation and control.
6. What is interoperability? And justify with an example.
7. Write the primary function of DMS.
8. Highlight the importance of the 'vehicle to grid' concept.
9. Give the importance of cyber security requirements in smart grid.
10. What is the role of sensor in smart grid architecture?

PART B — (5 × 13 = 65 marks)

11. (a) Compare conventional grid Vs smart grid and justify the comparison.

Or

(b) (i) Discuss about the smart grid developments in European countries. (7)

(ii) Explain the major global smart grid initiatives and policies taken in India. (6)

12. (a) Explain the phasor measurement unit by illustrating a synchronized phasor measuring system.

Or

(b) (i) Discuss in detail about vapour compression refrigeration cycle. (7)

(ii) Mention the key parameters needed to estimate savings from replacing a standard motor with an energy-efficient one in detail. (6)

13. (a) Discuss the role of SCADA implemented in a smart substation.

Or

(b) Analyse how the EMUs can be used in electrical power grid to enhance the power grid automation.

14. (a) Discuss in detail the fault detection, isolation and restoration (FDIR) scheme using IEC 61850 in peer-to-peer communication.

Or

(b) The PV system shown in Fig. 1 has two series-connected PV modules with the V-I characteristic shown in Fig. 2 and Fig. 3. The single phase inverter operates with sinusoidal PWM and is connected directly to the 230 V mains. The irradiance on the module is 1000 W/m².

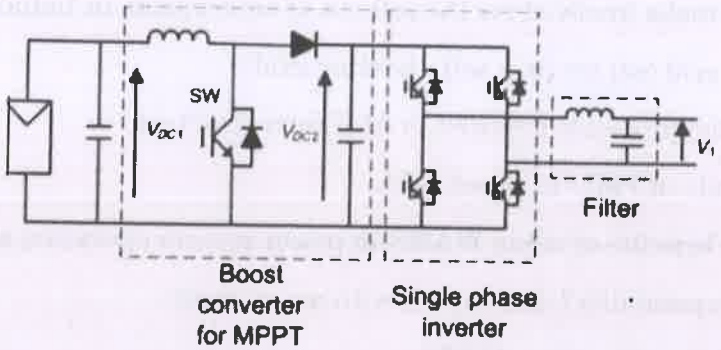

Fig. 1.

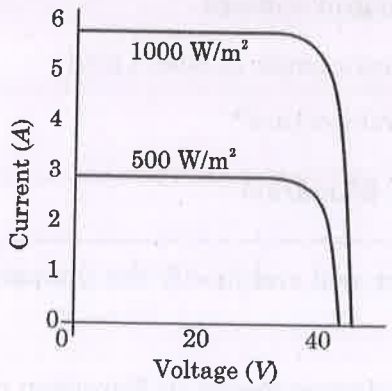

Fig. 2.

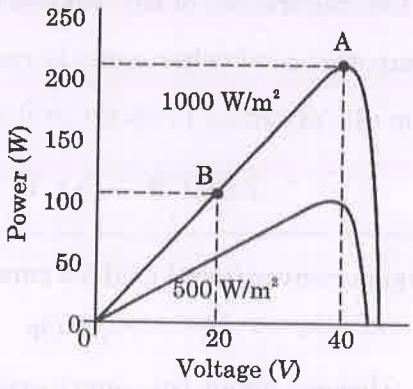

Fig. 3.

(i) Describe a possible control strategy which could be used. (3)

(ii) What should be the amplitude modulation index of the inverter to maintain VDC2 at 350V? (3)

(iii) Calculate the duty ratio of the switch SW that is required to extract maximum power. (4)

(iv) If, due to constraints the local power network, the output of the PV system was reduced by 50 per cent, calculate the new duty ratio required for switch SW. (3)

15. (a) Compare and explain about various communication technologies used in HAN and NAN in smart grid.

Or

(b) (i) Explain the cyber security challenges in smart grid.

(ii) Explain the role of IP based protocols in smart grid applications. (7 + 6)

PART C — (1 × 15 = 15 marks)

16. (a) Relate the role of cloud computing in smart grid and adapt automation at distribution level.

Or

(b) Demonstrate the renewable energy resource integration in the smart city development.