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EE 1818 PE 52

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Roll No. of candidate | | | | | | | | | | |

2023

B.Tech. 8th Semester End-Term Examination

SMART GRID TECHNOLOGY

New regulation (w.e.f. 2017-18) & New Syllabus (w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question Number 1 and *any four* Questions from the rest.

Write the correct option.

1. (i) Which of the following choices of voltage levels is most suitable for a smart house building?

(a) 12V, 24V and 48V DC (b) 24 V, 48V and 120V DC

(c) 48V, 120V and 220V DC (d) 120V, 220V and 325V DC

(ii) Smart Grid is self-healing because ———————

(a) Customers may be readily Supplied any amount of demand

(b) Relay settings can be intelligently modified

(c) Any fault can be quickly identified, isolated and service restored

(d) All of the above

(iii) Which of the following is true?

(a) Spinning reserves are reduced to minimum in smart grid

(b) Penetration of variable renewable energy (VRE) into base load decreases the cost of integration of VRE

(c) Direct Load Control is not a method of demand response

(d) Micro- grids are necessary for operation of a smart rid

(iv) A group of mostly renewable electricity generations, energy storages, and loads are characteristics of ———————

(a) Virtual Power Plant (b) Macro Grid

(c) Island (d) Conventional Grid

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(v) Smart grid is resilient because _____

(a) Any fault can be quickly identified, isolated and service restored

(b) It can withstand large disturbances like outage of a large power plant or switching on large load, while maintaining quality service

(c) It can accommodate non-dispatchable renewable energy sources

(d) It can remedy ageing effects of transmission lines.

(vi) NSGM abbreviates as _____

(a) National Smart Grid Meeting

(b) National Smart Grid Ministry

(c) National Smart Grid Movement

(d) National Smart Grid Mission

(vii) What is prime activity of a bay level equipment?

(a) Improve power quality of the network

(b) displays the station layout and the status of station equipment

(c) provide protection of various network components and a real-time assessment of the distribution network

(d) None of the above

(viii) The major task of a Smart Grid Mission implies _____

(a) To increase integration renewable energy sources

(b) Demand side integration

(c) To reduce technical and commercial losses

(d) All of the above

(ix) Demand side integration implies _____

(a) Integration of customer generations

(b) Integration of distributed generations in distribution grid

(c) integration of Micro-grids

(d) All of the above

(x) Which one of the following voltage transformers is more efficient in terms of accuracy, for 11 kV substation automation?

(a) Optical voltage transformer

(b) Voltage transformer with high voltage step-down Capacitor

(c) Voltage transformer without high voltage step-down capacitor

(d) All of the above

2. (a) Define Smart Grid. Discuss the key features of Smart Grid. (2 + 5 = 7)

(b) Information and Communication Technology (ICT) have a major role to play in the implementation of Smart Grids. Justify. 8

3. (a) In how many levels, a smart grid substation is organized? Show these levels in a schematic diagram? Enlist the equipment and their functions in different levels in brief. (1+2+3=6)

(b) Draw schematic layout diagram of a typical Energy Management System (EMS) system configuration and state functions of its chief components. (3+3=6)

(c) What are synchro-phasors? How they are measured in smart grid? (1+2=3)

4. (a) State the characteristics of Variable Renewable Energy (VRE). Give an example of VRE. Give an account of how smart grid technologies can act as enabler for VRE integration? (2+1+3=6)

(b) Give an account of energy storage devices in power system capable of delivering (i) short term power (kW) and (ii) energy (kWh) over a longer period, respectively. (2+2=4)

(c) Explain the automated meter reading (AMR) system with necessary block diagrams. How is AMR different from Advance Metering Infrastructure (AMI) of Smart Grid? (3+2=5)

5. (a) Discuss the advantages of low voltage DC (LVDC) distribution system in homes or commercial buildings. What are the major challenges of implementation of LVDC distribution system? (5+3=8)

(b) Draw a typical architecture of a smart home. What are the advantages and challenges of home area network, respectively? (2+3+2=7)

6. (a) Discuss the working of outage management system with necessary block diagram representation of the system. 7

(b) Define Net Energy Metering. Discuss in brief the operation of a Smart Net Energy Metering System with necessary circuit or block diagram representation of the system. 8

7. (a) Discuss the following methods of tariff design: (i) Time of the day pricing (TOD) and (ii) Time of use pricing (TOU). How do these methods effect the demand response? (2+2+3=7)

(b) Enumerate (i.e. state the list of) the benefits of smart grid. 8
