



CAPITAL UNIVERSITY - KODERMA

POWER STATION PRACTICE ASSIGNMENT

Name : Arshad Nazir

Electrical and Electronics Engineering

Signature:

Date :

1. Define smart grid concept and explain its necessity.

Smart Grid is a concept for transforming the electric power grid by using advanced automatic control and communications techniques and other forms of information technology. It integrates innovative tools and technologies from generation, transmission and distribution all the way to consumer appliances and equipment

2. Explain functions of smart grid components.

Smart Grid includes electric network, digital control appliance, and intelligent monitoring system. All of these, can deliver electricity from producers to consumers, control energy flow, reduce the loss of what, and make the performance of the electric network more reliable and controllable

3. List the smart appliances and describe an integration of smart appliances in to grid for home and building automation.

i, NAESB REQ.21 Energy Service Provider Interface (ESPI)

ii, OASIS Energy Interoperation for DR signals and market interactions

iii, Electrotechnical Commission (IEC) 62746-10-1 Open Automated Demand Response (OpenADR)

iv, Extensions to ASHRAE Building Automation Control Network standard (BACnet) for meter, price and distributed energy resource communications

v, Extension to BACnet web services to support Energy Interoperation

vi, Standards for residential appliances and industrial process control implementation

To develop the measurement science for industry standards that will enable interconnection of home and building automation and control systems with a future "smart" utility grid, provide consumers with energy usage information, and support industry efforts to develop the needed standards.

4. Explain outage management system

Techopedia Explains Outage Management System (OMS)

Prioritizes restoration efforts and management of resources upon outages

Provides supervisors with an estimated timeline of restoration

Reports the actual cause of the outage

Provides accurate information about the extent of the outage and its impact on customers and their management.

5. Explain the plug in hybrid electric vehicles.

A plug-in hybrid electric vehicle (PHEV) is a type of hybrid electric vehicle that combines a gasoline or diesel engine with an electric motor and a large battery that can be recharged by plugging into an electrical outlet or electric vehicle charging station.

6. Describe substation and feeder automation.

Automation involves the deployment of substation and feeder operating functions and applications ranging from supervisory control and data acquisition (SCADA) and alarm processing to integrated volt/var control in order to optimize the management of capital assets and enhance operation and maintenance (O&M) efficiencies with

minimal human intervention.

7. Explain the stages on evaluation of smart grid.

the proposed approach which can be divided into 5 stages:

- 1) Network-packet sniffing
- 2) Protocol packet filtering
- 3) Learning phase
- 4) Rules defining phase
- 5) Real-time detection

The first stage monitors the network traffic whenever the controller is sending control signals to the actuators in the power system. The second stage filters the normal DNP3 packets based on the IP addresses and port numbers. The third stage learns about the DNP3 packet function codes. Since the controller sends critical commands during the specific scenarios (faults/ contingencies), it has certain time related constraints.

8. Explain the smart substation.

Smart Substations: substations are included monitoring and control non-critical and critical operational data such as power status, power factor performance, breaker, security, transformer status, etc. substations are used to transform voltage at several times in many locations, that providing safe and reliable delivery of energy. Smart substations are also necessary for splitting the path of electricity flow into many directions.

9. Explain smart metering and advantages of it.

Advantages of Smart Meters

Eliminating manual meter reading  
Monitoring the electric system more quickly  
Making it possible to use power resources more efficiently  
Providing real-time data useful for balancing electric loads and reducing power outages (blackouts)  
Enabling dynamic pricing (raising or lowering the cost of electricity based on demand)

10. Compare conventional metering and smart metering.

By comparison, a conventional meter simply records overall usage and does not allow for monitoring. A conventional meter requires a meter reader to read it each month and simply displays a reading. From this reading, a bill is constructed after the electricity is consumed. Smart meters are more sophisticated in that they not only measure usage

11. Explain phase measuring unit.

Phasor measurement unit (PMU) Phasor measurement units (PMUs) and its measured synchrophasors make a valuable contribution to the dynamic monitoring of transient processes in energy supply systems. These data are the basis for the Wide Area Monitoring system SIGUARD PDP.

12. Explain wide area measurement system.

Synchronize measurement technology (Wide area

measurement system) is a new term considered to be one of the most important technologies in the future of power systems due to its unique ability to sample analogue voltage and current waveform data in synchronism with a Global positioning system (GPS) clock and compute the corresponding frequency component from widely dispersed locations.

13. Explain the role of smart meters to make the system smart.

Smart metering systems provide companies in the utilities sector with the ability to monitor media supply networks and efficiently respond to current events. Data can be obtained even from meters that are difficult to access and those located at long distances from each other.

14. Explain super conducting magnetic energy storage

Superconducting magnetic energy storage (SMES) is an energy storage technology that stores energy in the form of DC electricity that is the source of a DC magnetic field.

15. Explain pumped hydro and compressed air energy storage

The working principles of the compressed air storage systems are largely equivalent to the pumped hydro ES system. The aim of the compressed air storage system is to shift the peak energy demands to the off-peak demand period or to store renewables for later use, as same as pumped hydro ES.

16. Explain the concept of micro grid, and its need and applications.

microgrid strategy that integrates local wind or solar resources can provide redundancy for essential services and make the main grid less susceptible to localized disaster. Buildings equipped with electric generation capabilities through solar panels and contingency generators can also generate energy and revenue during downtime.

17. Explain the protection and control of micro grid.

Microgrids have been proposed in order to improve reliability and stability of electrical system and to ensure power quality of grid. Microgrid consists of low voltage distribution systems with distributed energy resources, such as wind turbine and photovoltaic power systems, together with storage devices. It is essential to protect a micro grid in both the grid-connected and the islanded mode of operation against all different types of faults. This paper describes micro grid protection and safety concept with central control and monitoring unit where multifunctional intelligent digital relay could be used. This central control & monitoring infrastructure is used for adaptive relay settings strategy for micro grid protection. Also operational safety design concept and fault mitigation technique is proposed to ensure confidence in protection system.

18. Compare micro grid and smart grid.

In comparison to microgrids, smart grids have digital information and control, dynamic optimisation of grid operation and resources, distributed resources (similar with microgrids or specifically smart microgrids), demand responses, demand-side resources, energy efficiency (EE) resources, smart metering system, smart integration (real-time response and timely information on consumption) and advanced electricity storage.

19. Explain plastic and organic solar cells.

An organic solar cell (OSC) or plastic solar cell is a type of photovoltaic that uses organic electronics, a branch of electronics that deals with conductive organic polymers or small organic molecules, for light absorption and charge transport to produce electricity from sunlight by the photovoltaic effect.

20. Explain thin film solar cells.

A thin-film solar cell is a second generation solar cell that is made by depositing one or more thin layers, or thin film (TF) of photovoltaic material on a substrate, such as glass, plastic or metal.

21. Explain variable speed wind generators.

A variable speed wind turbine is one which is specifically designed to operate over a wide range of rotor speeds. It is in direct contrast to fixed speed wind turbine where the rotor speed is approximately constant. The reason to vary the rotor speed is to capture the maximum aerodynamic power in the wind, as the wind speed varies.

22. Explain the importance of power quality in smart grid. How the power quality can be improved in smart grid.

The Smart Grid includes several components that help utilities better deliver quality power to your home: smart meters and technology on the distribution grid that helps manage voltage and power factor.

23. Explain the role of EMC in smart grid.

With the Smart Grid network, our focus as compliance engineers, both safety and EMC, must be on determining what to work on first; emission or immunity threats, compliance with regulatory standards or electromagnetic compatibility, testing components or finished assemblies, incorporating functional safety, or implementing power saving features.

24. Explain about power quality Audit and its applications.

An energy audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprint.