



SRM VALLIAMMAI ENGINEERING COLLEGE

*(An Autonomous Institution)*

SRM Nagar, Kattankulathur-603203.



## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTIONBANK



**VIII Semester**

**1905810 - SMART GRID**

Regulation-2019

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

Course Code & Name: **1905810 SMART GRID**

Semester/ Year : VIII / 2022-2023 (EVEN)

<b>UNIT I - INTRODUCTION TO SMART GRID</b>				
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid. Power Distribution utility in India, IEEE communication surveys.				
1	What is smart substation?	BTL 4	Analyze	CO1
2	Define Smart Grid.	BTL 1	Remember	CO1
3	Define real time pricing.	BTL 4	Analyze	CO1
4	List different smart appliances used in home and building automation.	BTL 1	Remember	CO1
6	Enumerate the initiatives taken by Indian economy for smart grid.	BTL 2	Understand	CO1
7	Summarize self-healing grid.	BTL 5	Evaluate	CO1
8	Integrate feeder automation.	BTL 6	Create	CO1
9	Show the challenges relate to smart grid.	BTL1	Remember	CO1
10	Define smart sub-station.	BTL 1	Remember	CO1
11	Evaluate the necessity of Smart Grid system.	BTL 5	Evaluate	CO1
12	What is the need of distribution management system in electric power distribution system?	BTL 1	Remember	CO1
13	What is Resilient Grid?	BTL 3	Apply	CO1
14	Generalize the prominent international policies in smart grid.	BTL 6	Create	CO1
15	List the opportunities related to smart grid.	BTL 1	Remember	CO1
16	State self healing grid.	BTL 2	Understand	CO1
17	Show the characteristics of an ideal smart grid.	BTL 3	Apply	CO1
18	Examine the major global smart grid initiatives in India.	BTL 3	Apply	CO1
19	Distinguish national and international initiatives in smart grid.	BTL 2	Understand	CO1
20	Discuss the present development in smart grid.	BTL 2	Understand	CO1
21	What are the main challenges that the electric grid faces?	BTL 1	Remember	CO1
22	Explain approaches for demand management from the list below.	BTL 2	Understand	CO1
23	Difference between Traditional Power Grid and Smart Grid	BTL 3	Apply	CO1
24	Show the challenges relate to smart transmission systems.	BTL 2	Understand	CO1
Part – B				

1	Examine the evolution of electric grid. (13)	BTL 1	Remember	CO1
2	Explain concept of micro grid, its need and applications. (13)	BTL 4	Analyze	CO1
3	Summarize smart grid drivers and functions. (13)	BTL 5	Evaluate	CO1
4	Analyze the need of smart grid and explain neatly with detailed reasons. (13)	BTL 4	Analyze	CO1
5	Define smart grid and describe the need for smart grid. (13)	BTL 1	Remember	CO1
6	Discuss the challenges and benefits in smart grid. (13)	BTL 2	Understand	CO1
7	Integrate the concept of resilient. (13)	BTL 6	Create	CO1
8	Estimate the self-healing grid. (13)	BTL 2	Understand	CO1
9	Describe the national initiatives in smart grid systems. (13)	BTL 1	Remember	CO1
10	Explain the present development and international policies in smart grid. (13)	BTL 4	Analyze	CO1
11	Discuss the international initiatives in smart grid. (13)	BTL 2	Understand	CO1
12	Examine the overview of the technologies required for the smart grid. (13)	BTL 1	Remember	CO1
13	Illustrate the present development in smart grid. (13)	BTL 3	Apply	CO1
14	Discuss the difference between conventional grid and smart grid. (13)	BTL 3	Apply	CO1
15	Explain how Smart Appliances can be the part of Smart Grid. (13)	BTL 4	Analyze	CO1
16	Write a note on opportunity and barriers in Smart Grid. (13)	BTL 2	Understand	CO1
17	High light on evolution of electric Grid and the Concept of Smart Grid. (13)	BTL 1	Remember	CO1
<b>Part-C</b>				
1	Explain in detail about international experience in smart grid deployment efforts. (15)	BTL 6	Create	CO1
2	Explain in detail about the architecture of the smart grid. (15)	BTL 5	Evaluate	CO1
3	Explain neatly about the smart grid roadmap for India. (15)	BTL 5	Evaluate	CO1
4	Generalize the international policies in smart grid and explain the national and international initiatives in smart grid. (15)	BTL6	Create	CO1
5	Explain neatly about the Smart grid IEEE communication surveys. (15)	BTL 5	Evaluate	CO1
<b>UNIT II - SMART GRID TECHNOLOGIES</b>				
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution, Transformers, Phase Shifting Transformers, Plug-in Hybrid Electric				

Vehicles(PHEV).				
1	What is sub-station automation?	BTL 1	Remember	CO2
2	What is smart sub-station automation?	BTL 1	Remember	CO2
3	Examine the wide area monitoring system in a transmission network.	BTL 3	Apply	CO2
4	State energy management system in smart grid.	BTL 5	Evaluate	CO2
5	Discuss the smart grid technology frame work.	BTL 2	Understand	CO2
6	Discuss the feeder automation.	BTL 2	Understand	CO2
7	Integrate the drivers and benefits of WAMPAC.	BTL 6	Create	CO2
8	What are the major WAMPAC activities?	BTL 1	Remember	CO2
9	Discuss the role of WAMPAC in a smart grid.	BTL 4	Analyze	CO2
10	Summarize the FACTS in smart grid	BTL 5	Evaluate	CO2
11	Estimate the distribution SCADA.	BTL 2	Understand	CO2
12	Compare the benefits of voltage and VAR control.	BTL 4	Analyze	CO2
13	List Volt/VAR control equipment on distribution feeder.	BTL 2	Understand	CO2
14	What is FDIR implementation?	BTL 1	Remember	CO2
15	Examine the isolation and service restoration.	BTL 3	Apply	CO2
16	Define the outage management.	BTL 1	Remember	CO2
17	Identify the faults on distribution systems.	BTL1	Remember	CO2
18	Generalize the phase shifting transformers.	BTL 6	Create	CO2
19	Analyze the high efficiency distribution transformers.	BTL 4	Analyze	CO2
20	Explain the role of PHAN in smart grid.	BTL 3	Apply	CO2
21	Discuss the role of FACTS in smart grid.	BTL 3	Apply	CO2
22	What are the requirement of smart sub-station automation?	BTL 1	Remember	CO2
23	What are the Volt/VAR control technique applied in smart grid.	BTL1	Remember	CO2
24	Explain Role of Smart Meters in Smart Grid .	BTL1	Remember	CO2
Part-B				
1.	Define smart substations and explain in detail. (13)	BTL 1	Remember	CO2
2.	Analyze the technology drivers and smart energy resources. (13)	BTL 4	Analyze	CO2
3	Examine the substation automation. (13)	BTL 1	Remember	CO2
4	Summarize the feeder automation. (13)	BTL 5	Evaluate	CO2
5	Illustrate the advances in energy management systems for the smart grid. (13)	BTL 3	Apply	CO2
6	Examine the flexible ac transmission systems in smart grid. (13)	BTL 3	Apply	CO2
7	Integrate the high voltage direct current in smart grid. (13)	BTL 6	Create	CO2
8	Explain the role of WAMPAC in a smart grid. (13)	BTL 1	Remember	CO2
9	Analyze the wide area monitoring and protection and control. (13)	BTL 4	Analyze	CO2
10	Discuss in detail about advanced distribution management systems in smart grid. (13)	BTL 2	Understand	CO2

11	Discuss high-efficiency distribution transformers in smart grid. (13)	BTL 2	Understand	CO2
12	Examine Volt/VAR control and fault detection in smart grid. (13)	BTL 1	Remember	CO2
13	Estimate the isolation and service restoration and phase shifting transformers. (13)	BTL 2	Understand	CO2
14	Explain Plug in Hybrid Electric Vehicles (PHEV). (13)	BTL 4	Analyze	CO2
15	Explain the application of SANET in Smart Grid.	BTL 2	Understand	CO2
16	Write a note on present development in Smart Grid considering any one case study.	BTL 1	Remember	CO2
17	Explain how Smart Meters can be play an important role to make a system Smart.	BTL 2	Understand	CO2
Part-C				
1.	Evaluate the smart grid technology framework. (15)	BTL 5	Evaluate	CO2
2.	Design the IEC 61850 based substation. (15)	BTL 6	Create	CO2
3.	Summarize the role of transmission systems in smart grid. (15)	BTL 5	Evaluate	CO2
4.	Explain outage management and FDIR implementation in smart grid. (15)	BTL 6	Create	CO2
5	List the SANET actors and explain the requirements of these for different Smart Grid applications.	BTL 5	Evaluate	CO2
<b>UNIT III - SMART METERS AND ADVANCED METERING INFRASTRUCTURE</b>				
Introduction to Smart Meters, Advanced Metering in frastructure(AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED )& their application for monitoring & protection				
Part-A				
1.	Define AMI standards.	BTL 1	Remember	CO3
2.	Analyze the evolution of electric meter.	BTL 4	Analyze	CO3
3.	Evaluate the AMI drivers and benefits.	BTL 5	Evaluate	CO3
4.	Quote the AMI protocols.	BTL 1	Remember	CO3
5.	Point out the smart energy profile.	BTL 4	Analyze	CO3
6.	Describe the AMI needs in the smart grid.	BTL 2	Understand	CO3
7.	Examine the AMI security requirements.	BTL 3	Apply	CO3
8.	Generalize the time synchronization.	BTL 6	Create	CO3
9.	Illustrate the internal device management.	BTL 3	Apply	CO3
10.	Discuss the common information model.	BTL 2	Understand	CO3
11.	Evaluate the testing and diagnostics.	BTL 5	Evaluate	CO3
12.	Explain the local connectivity.	BTL 4	Analyze	CO3
13.	Write short note remote configuration.	BTL 2	Understand	CO3
14.	Define meter data reads.	BTL 1	Remember	CO3
15.	Identify the back office functions of AMI system.	BTL 1	Remember	CO3
16.	What is synchrophasor?	BTL 1	Remember	CO3
17.	Give the applications of phasor measurement unit.	BTL 2	Understand	CO3

18.	Integrate the intelligent electronic devices	BTL 6	Create	CO3
19.	Illustrate the application of intelligent electronic devices.	BTL 3	Apply	CO3
20.	Define phasor measurement unit.	BTL 1	Remember	CO3
21	List various components of Advanced Metering Interface (AMI).	BTL 1	Remember	CO3
22	Define Intelligent Electronic Devices(IED).	BTL 1	Remember	CO3
23	List the AMI protocols.	BTL 2	Understand	CO3
24	Advantages of Intelligent Electronic Devices(IED ).	BTL 2	Understand	CO3
<b>Part-B</b>				
1.	Discuss the evolution of meter reading. (13)	BTL 2	Understand	CO3
2.	Illustrate the AMI drivers and benefits. (13)	BTL 3	Apply	CO3
3.	Examine the AMI protocols standards and initiatives. (13)	BTL 1	Remember	CO3
4.	Describe the smart energy profile. (13)	BTL 1	Remember	CO3
5.	Explain the firmware upgrades and time synchronization in smart grid. (13)	BTL 4	Analyze	CO3
6.	Summarize the AMI security threats. (13)	BTL 2	Understand	CO3
7.	Explain the integration with utility enterprise applications. (13)	BTL 4	Analyze	CO3
8.	What is local connectivity? Explain the remote configuration. (13)	BTL 1	Remember	CO3
9.	Discuss the IEC 62056 DLMS COSEM standard. (13)	BTL 2	Understand	CO3
10.	Generalize the phasor measurement unit application for monitoring & explain the protection also. (13)	BTL 6	Create	CO3
11.	Explain the IED application for monitoring & Explain the protection also. (13)	BTL 4	Analyze	CO3
12.	Evaluate the intelligent electronic devices.(13)	BTL 5	Evaluate	CO3
13.	Illustrate the phasor networks installation and applications. (13)	BTL 3	Apply	CO3
14.	What is Phasor Measurement Unit (PMU)? Explain in detail. (13)	BTL 1	Remember	CO3
15	Explain applied in IED smart grid.	BTL 6	Create	CO3
16	Briefly explain the architecture of Intelligent Electronic Devices(IED ) unit.	BTL 4	Analyze	CO3
17	Briefly explain the architecture of PMUs unit.	BTL 5	Evaluate	CO3
<b>Part-C</b>				
1.	Explain the critical infrastructure protection security requirements in smart grid. (15)	BTL 5	Evaluate	CO3
2.	Generalize the AMI needs in the smart grid system. (15)	BTL 6	Create	CO3
3.	Explain in detail about Advanced Metering infrastructure (AMI) drivers and benefits. (15)	BTL 5	Evaluate	CO3
4.	Evaluate IED and PMU. (15)	BTL 6	Create	CO3
5	What are the challenges in implementing demand side management in smart grid?	BTL 5	Evaluate	CO3
<b>UNIT IV - POWER QUALITY MANAGEMENT IN SMART GRID</b>				
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable				

Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.				
1.	Analyze the power quality management in smart grid.	BTL 4	Analyse	CO4
2.	What is EMC in smart grid?	BTL 1	Remember	CO4
3.	Examine the Photovoltaic systems in smart grid.	BTL 3	Apply	CO4
4.	Summarize the control of wind turbine.	BTL 5	Evaluate	CO4
5.	Illustrate the control of hydro turbine.	BTL 3	Apply	CO4
6.	Generalize the fault current limiting.	BTL 6	Create	CO4
7.	Draw the diagram of decoupled current control method for D-STATCOM.	BTL 1	Remember	CO4
8.	What is load compensation?	BTL 2	Understand	CO4
9.	Discuss the voltage control.	BTL 2	Understand	CO4
10.	Estimate the shunt active filter.	BTL 2	Understand	CO4
11.	Quote applications of VSC-ES.	BTL 1	Remember	CO4
12.	Summarize the series compensation in smart grid.	BTL 2	Understand	CO4
13.	Analyze the thyristor-controlled phase shifting transformer.	BTL 4	Analyze	CO4
14.	Define unified power flow controller.	BTL 1	Remember	CO4
15.	Explain the interline power flow controller.	BTL 4	Remember	CO4
16.	Integrate the CSC-HVDC.	BTL 6	Create	CO4
17.	What is a voltage source converter?	BTL 1	Remember	CO4
18.	Evaluate the components of a VSC.	BTL 5	Evaluate	CO4
19.	Examine the web based power quality monitoring.	BTL 3	Apply	CO4
20.	What is power quality audit?	BTL 1	Remember	CO4
21.	List the various power quality disturbances in the grid.	BTL 4	Analyze	CO4
22.	Explain EMC in Smart Grid.	BTL 1	Remember	CO4
23.	Integrate the VSC-HVDC.	BTL 4	Remember	CO4
24.	Summarize the shunt compensation in smart grid.	BTL 6	Create	CO4
Part-B				
1.	Describe the power quality in smart grid. (13)	BTL 1	Remember	CO4
2.	Examine the EMC in smart grid. (13)	BTL 3	Apply	CO4
3.	Generalize the photovoltaic systems in smart grid. (13)	BTL 6	Analyze	CO4
4.	Illustrate the fault current limiting in smart grid. (13)	BTL 3	Apply	CO4
5.	Explain the shunt compensator with energy storage in smart grid. (13)	BTL 4	Analyze	CO4
6.	Explain the thyristor-controlled phase shifting transformer in smart grid. (13)	BTL 4	Analyze	CO4
7.	Evaluate the power quality conditioners for smart grid. (13)	BTL 5	Create	CO4
8.	Explain the wind hydro and tidal energy systems in smart grid. (13)	BTL 4	Analyze	CO4
9.	Discuss the series compensation and active filter for smart grid. (13)	BTL 2	Understand	CO4

10.	Summarize the energy storage technologies for smart grid. (13)	BTL 2	Understand	CO4
11.	Describe power quality conditioners for smart grid. (13)	BTL 1	Remember	CO4
12.	Describe web based power quality monitoring in smart grid. (13)	BTL 1	Remember	CO4
13.	Estimate the power quality audit for smart grid. (13)	BTL 2	Understand	CO4
14.	Describe the superconducting magnetic energy storage systems and Super capacitors. (13)	BTL 1	Remember	CO4
15.	Write down the transmission protocol of IEC 61850.	BTL 2	Understand	CO4
16.	List and explain various power quality issues with smart grids.	BTL 1	Remember	CO4
17.	Evaluate the Power Quality issues of Grid connected Renewable Energy Sources	BTL 1	Remember	CO4
<b>Part-C</b>				
1.	Explain the power quality audit in smart grid and also explain web based power quality monitoring. (15)	BTL 5	Evaluate	CO4
2.	Prepare the case study of energy storage for wind power. (15)	BTL 6	Create	CO4
3.	Evaluate the power quality issues of grid connected renewable energy sources. (15)	BTL 5	Evaluate	CO4
4.	Integrate the case study of agent-based control of electrical vehicle battery charging. (15)	BTL 6	Create	CO4
5.	Briefly explain various harmonic indices in smart grid.	BTL 5	Evaluate	CO4
<b>UNIT V - HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS</b>				
Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.				
<b>Part - A</b>				
Q.No.	Questions	BT Level	Competence	Course Outcome
1.	What is HAN?	BTL 1	Remember	CO5
2.	Generalize the two options used in HAN services in demand side management.	BTL 6	Create	CO5
3.	Discuss the networking fundamentals.	BTL 2	Understand	CO5
4.	Define LAN.	BTL 5	Evaluate	CO5
5.	Estimate the wide area network.	BTL 2	Understand	CO5
6.	Point out the benefits of home area network.	BTL 4	Analyze	CO5
7.	Analyze the various challenges to HAN.	BTL 4	Analyze	CO5
8.	Illustrate the role of WAN in smart grid.	BTL 3	Apply	CO5
9.	What are the requirements for a private wireless WAN?	BTL 1	Remember	CO5
10.	Examine the BPL.	BTL 1	Remember	CO5
11.	Examine the IP based protocols.	BTL 3	Apply	CO5
12.	Describe the cloud computing to make smart grids smarter.	BTL 1	Remember	CO5
13.	Quote the cloud computing applications for	BTL 1	Remember	CO5



	smart grid.			
14.	Examine the basics of web service.	BTL 3	Apply	CO5
15.	Estimate the cyber security requirements in smart grid.	BTL 2	Understand	CO5
16.	State the mitigation approach to cyber security risks.	BTL 2	Understand	CO5
17.	Generalize the cyber security risks for smart grid.	BTL 6	Create	CO5
18.	What is the cloud computing in smart grid?	BTL 1	Remember	CO5
19.	Summarize the cyber security for smart grid.	BTL 5	Evaluate	CO5
20.	Write short note on real time path rating.	BTL 4	Analyze	CO5
21.	What are the various types of clouds?	BTL 2	Understand	CO5
22.	Describe the challenges and benefits of Home Area Network(HAN).	BTL 6	Create	CO5
23.	List the advantages of cloud computing.	BTL 1	Remember	CO5
24.	What are the various sources of harmonics in a smart grid?	BTL 5	Evaluate	CO5
Part – B				
1.	Generalize the networking fundamentals for smart grid. (13)	BTL 6	Create	CO5
2.	Evaluate Local Area Network (LAN). (13)	BTL 5	Evaluate	CO5
3.	Discuss in detail House Area Network (HAN). (13)	BTL 2	Understand	CO5
4.	Describe Wide Area Network (WAN). (13)	BTL 2	Understand	CO5
5.	Illustrate the Broadband over Power line (BPL) for smart grid. (13)	BTL 3	Apply	CO5
6.	Estimate that IP is the right foundation for the smart grid. (13)	BTL 2	Understand	CO5
7.	Examine the basics of web service in smart grid. (13)	BTL 1	Remember	CO5
8.	Describe the cloud computing to make smart grids smarter. (13)	BTL 1	Remember	CO5
9.	Illustrate the cyber security functions for smart grid. (13)	BTL 3	Apply	CO5
10.	Examine the authentication and authorization services in cyber security. (13)	BTL 1	Remember	CO5
11.	Analyze the network security services. (13)	BTL 4	Analyze	CO5
12.	Describe the confidentiality and integrity in security system. (13)	BTL 1	Remember	CO5
13.	Explain the system integrity and network integrity in security functions. (13)	BTL 4	Analyze	CO5
14.	Explain the security threats. (13)	BTL 4	Analyze	CO4
15.	Explain cloud computing infrastructure	BTL 4	Analyze	CO5
16.	Explain with neat sketch cloud computing architecture	BTL 1	Remember	CO5
17.	Write brief notes on Distortion Index (DIN).	BTL 4	Analyze	CO5
Part – C				
1.	Explain networking fundamentals and local area network. (15)	BTL 5	Evaluate	CO5
2.	Generalize computational challenges in a smart grid. (15)	BTL 6	Create	CO5

3.	Evaluate basics of web service and cyber security for smart grid. (15)	BTL 5	Evaluate	CO5
4.	Integrate legacy transmission and distribution automation and also explain the advancing smart grid standards. (15)	BTL 6	Create	CO5
5	Explain the role of NAN in smart grid technology. (15)	BTL 5	Evaluate	CO5

**Course Outcomes:**

<b>Cos</b>	<b>Course Outcome</b>
CO1	Learners will develop more understanding on the concepts of Smart Grid and its present developments.
CO2	Learners will study about different Smart Grid technologies.
CO3	Learners will acquire knowledge about different smart meters and advanced Metering infrastructure.
CO4	Learners will have knowledge on power quality management in Smart Grids.
CO5	Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.