UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Distribution Automation & Smart Grid **Semester: II**
Program: MBA Power Management **Time: 03 Hours**
Course code: PIPM 7008 **Max. Marks: 100**
Pages : 3

Section A

1	Write Short Note on : a. CoAP b. MQTT c. SMQTT d. ZIGBEE e. RFID f. IEC Standard g. RPL h. SCADA i. IEEE j. 6LowPAN	**[10X2]**	**CO1**
	SECTION B (Attempt all Questions**)**		
1	Elaborate the duties of a Electricity Distribution planner	**[5]**	**CO2**
2	What is OSI? Explain	**[5]**	**CO1**
3	What is Demand Management? What schemes can be implemented in Demand Management	**[5]**	**CO2**
4	What is the difference in Regression, ARIMA and Fuzzy logic method of electricity load forecasting?	**[5]**	**CO2**
	SECTION C (Attempt any TWO questions)		
1.	Critically analyze distribution system planning process	**[15]**	**CO2**

2.	Critically analyze the Smart Grid policies of USA, Europe and Asian countries.	**[15]**	**CO3**
3.	How will you balance the direct cost of service and the indirect cost of interruption? Explain with graph.	**[15]**	**CO4**
4	Critically analyze the economic evaluation of Solar rooftop PV setup. Explain with suitable example	**[15]**	**CO4**
	SECTION D		
1	**Read the case and answer the following questions:** As American cities invest in improving their overall infrastructure, they face the challenge of addressing aging electrical grids and distribution systems. For many state and local agencies, the time is right to take that challenge head-on – and California is helping to lead that charge. In fact, about 20% of all bids and Requests for Proposals (RFPs) related to smart grid design and engineering come from the Golden State. California has had smarter meter integration than any other state in the country, and has used one of the nation's most aggressive renewable energy policies to push these efforts forward. The state continues to advance policies that require a modern energy grid, such as creating energy storage mandates. According to the GridWise Alliance, California "approaches these issues in a comprehensive way, so that the various elements of its greenhouse gas reduction strategy tend to work together." A recent study found that the United States had installed 65 million smart meters by the end of 2015. Two California utilities – Pacific Gas & Electric and Southern California Edison – topped the list with more than 5 million smart meters each. One of the many California government agencies willing to invest in smart meters is the City of Palo Alto. The city was considering implementing a smart grid as far back as 2011. After a thorough review, the city decided to wait a few years to allow technology to mature	**[30]**	**CO4, CO3**

	and bring down the costs of implementing Advanced Metering Infrastructure (a type of smart meter that uses two-way communication to track data in real time). Now that smart meter technology has improved and gained more widespread use, they've decided the time is right. Palo Alto recently released a RFP, tracked in the Onvia Exchange, to seek companies providing consulting help for developing their smart grid strategy over the next five years. They plan to spend an estimated $11 million over four years to implement their Smart Grid Road Map. With proactive, evolving policies and smart meter technology in place, California appears poised to remain the leaders in smart meters for years to come 1. What is Smart Meter? Explain in terms of Net metering and Gross metering. (10) 2. What is RFP ? How RFP differs from RFQ ? (5) 3. What power utility should do before implementing smart meter/ AMI for any of the Indian city? (15)		

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Section A

1	Write Short Note on : a. MQTT b. RFID c. IEEE standards d. OSI e. ARIMA f. Fuzzy Logic g. DSM h. Net metering i. Gross Metering j. MMI	**[10X2]**	**CO1**
	SECTION B (Attempt all Questions**)**		
1	What is Data Protocol? Explain with one example	**[5]**	**CO2**
2	What is CoAP? Explain	**[5]**	**CO2**
3	What is Transport Protocol? Explain with one example	**[5]**	**CO2**
4	What is the functions of PLC? Explain with a example	**[5]**	**CO3**
	SECTION C (Attempt any TWO questions)		

1.	Explain Load forecasting models and parameters to be used with suitable example	**[15]**	**CO3**
2.	Critically analyze the Smart Grid policies of USA, Europe and Asian countries.	**[15]**	**CO3**
3.	Explain IoT system for a Smart Grid with suitable block diagram	**[15]**	**CO2**
	SECTION D		
1	**Introduction** In New York, the Smart Grid Demonstration Program (SGDP) project of the Long Island Power Authority (LIPA) is improving cybersecurity while expanding the advanced metering infrastructure (AMI). Located on Long Island along New York business route 110, the Smart Energy Corridor demonstration project began in February 2010 and runs until February 2015. Partners include the Research Foundation of the State University of New York (SUNY) at Farmingdale and the Research Foundation of SUNY at Stony Brook. LIPA, the country's second-largest utility in terms of revenue, operates from Long Island, NY, and serves 1.1 million customers. It is modernizing its electric distribution systems with a $25.3-million cooperative research agreement including $12.5 million of U.S. Department of Energy funding under its Smart Grid Demonstration Program. With this Recovery Act funding, LIPA is creating a smart energy corridor by demonstrating the integration of AMI technology with other technologies to serve various smart grid applications. Already, LIPA has added 2,550 new smart meters and a customer web portal during the demonstration project. Other AMI additions include six pad mount housing (PMH) underground switches, 17 automatic sectionalizing units (ASUs), and 51 two-way capacitor bank controllers. Fuzzers, Rapid Response Aid Cybersecurity Smart meters use a "defense in depth" strategy to resist attacks. Their defenses include frequency hopping cryptography to resist eavesdropping and message tampering attacks, and careful coding to avoid well-known classes of vulnerabilities, such as buffer overflows. The LIPA cybersecurity team at SUNY at Stony Brook found that frequency hopping alone is not sufficient to resist eavesdropping and message injection attacks.	**[30]**	**CO4**

They are further evaluating meter security using a type of computer software program known as a fuzzer. This software detects security bugs by sending invalid messages to specified target devices. If the target devices do not respond appropriately to the invalid messages, it indicates that a bug is likely. “The security team has not found any serious security flaws in the meters we’ve deployed on our network,” said Ming Mui, principal investigator for the LIPA demonstration project. “We will continue to evaluate meter security, but the results have increased our confidence in the security of our network.” In another area, the research team demonstrated how a specialized compiler that analyzes computer code can work with a network-alert system to protect virtually all nodes against attack. The system enables a node that detects an attack to alert other nodes in the system and provide them with the information they need to protect themselves from the cyber-attack. The nodes can quickly spread this defensive knowledge throughout the network, effectively containing the attack. “This blue-sky research shows how to build cybersecurity systems that can react to new attacks and vulnerabilities that are discovered after deployment,” Mui said. “This capability is crucial for critical infrastructure that must operate continuously for years, if not decades.” Customers Involved in Monitoring Energy Use With improved cybersecurity comes the opportunity for greater customer involvement, a desired result of the smart grid. To help customers learn about more efficient energy use, researchers developed and provided a web portal tool for customers who received an AMI meter. So far, the portal has proven useful. Customers report that the usage and cost data provided by the portal helps them reduce their energy use and costs. “Having customers better understand their energy use is the first step towards consumption-behavior change,” Mui said.

In late 2012, the course of the LIPA demonstration project drastically changed when Hurricane Sandy hit the eastern U.S. In spite of the devastation, LIPA took advantage of the opportunity to learn about adapting the smart grid to function in inclement weather. Not surprisingly, researchers found that during fair weather and moderate storms, distribution automation (including ASUs and PMHs) continued system operations by performing circuit switching to minimize the number of customer outages. In areas of greater devastation, however, due to Sandy’s prolonged power outages, the energy stored

	in the batteries that operate the ASUs was depleted, necessitating manual operation of distribution switches. According to Mui, "Sandy accentuated the importance of training to complement automation." Next Steps In Hurricane Sandy's aftermath, LIPA is working with suppliers on extended-life batteries and will be providing additional training to restoration personnel. To increase public understanding about the safety of AMI technologies, LIPA researchers are now working with SUNY at Stony Brook to perform electromagnetic field testing of AMI meters. The AMI meters' electromagnetic fields will then be compared to those of common household appliances. 1. What LIPA researchers got to know after Hurricane Sandy ? (5) 2. How Cyber security had been enhanced in Smart Grid ? (10) 3. How will you like to involve the system of Smart Grid mentioned in the case study for the city of Dehradun ? (15)		