



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION – JAN 2023

Course Code: EEE 223

Course Name: Introduction to Smart Grid Technology

Program : B. Tech

Date: 24-JAN-2023

Time: 1:00 PM-4:00 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries TWO marks.

(5Qx 4M=20M)

1. The traditional electrical power grid is unidirectional in nature, where the electricity flows from power generation facilities to end users. This system has served well for the last hundred years. List the characteristics of the modern smart grid (C.O.No.1) [Knowledge]
2. In smart grid, energy storage technologies are emerging to words the developed power grid. List out advantages and disadvantages of the pumped storage hydro power stations. (C.O.No.2) [Knowledge]
3. Mention the Phase Measurement Unit (PSU) used in the smart energy systems with neat diagram. (C.O.No.4) [Knowledge]
4. In smart metering Analog to digital converter (ADC) is used for converting digital data to analog data. For the 8-bit ADC, the voltage range is 1.6 V (-2 to 2). Calculate the resolution of the ADC. (C.O.No.2) [Knowledge]
5. In communication topologies of smart grid, List out the main components of smart meter with neat diagram. (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries FOUR marks.

(5Qx 8M=40M)

6. A specification sheet of a smart meter states that its rated current is 100 A and power dissipation is 3 W. It employs a current-sensing resistor of 200 μohm . When the load current is at the rated value of the meter, calculate:
 1. the power dissipation in all the other components of the meter
 2. the voltage across the current-sensing resistor;
 3. the gain of the PGA to match with an ADC having a full scale of 5 V.(C.O.No.3) [Comprehension]

7. A smart meter uses the same 16-bit analogue to digital converter for both current and voltage measurements. It uses a 100 : 5 A CT for current measurements and 415: 10 V potential divider for voltage measurements. When the meter shows a current measurement of 50 A and a voltage measurement of 400 V, what is the maximum possible error in the apparent power reading due to the quantisation of the voltage and current signals? (C.O.No.2) [Comprehension]
8. In smart grid technology, explain the level of adoption and type of communication through the smart metering. Tabulate the benefits in short and long term of the advanced metering clearly. (C.O.No.2) [Comprehension]
9. In network communication in the smart grid, Switching techniques are used to establish a link between a Source and a Destination and to transmit data across a shared medium communication channel. Differentiate the virtual and datagram packet switching technique. (C.O.No.4) [Comprehension]
10. In India for smart grid development, several smart energy resources are developed. Write the different smart energy storage Techniques with pros and cons. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. Question carries TWENTY marks.

(2Qx 20M=40M)

11. An Electric engineer wants to find the error in the estimated power flow. The power flow on the transmission line in Fig.1 is 5 pu and the voltage at both busbars is 1.0 pu. The system frequency is 50 Hz. The power flow is estimated using the phase difference between busbars 1 and 2, that is using $\phi_1 - \phi_2$. The measurement of the phase angle ϕ_1 has a time stamp error of 0.1ms and that of the phase angle ϕ_2 is zero.

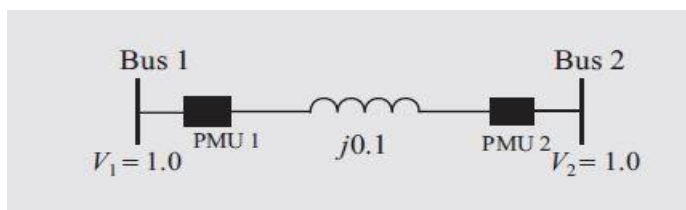
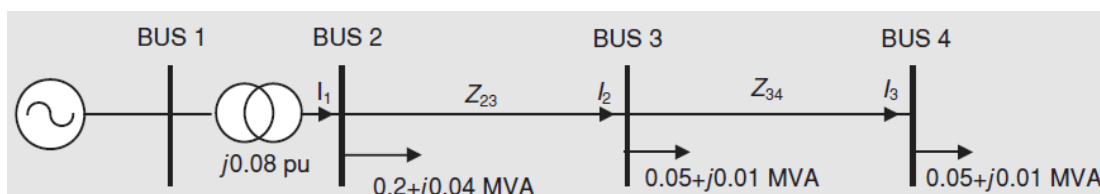


Fig.1

(C.O.No.2) [Comprehension]

12. For the network shown in Fig.2 , show two iterations of the forward/backward method.



$$Z_{23} = 0.05 + j0.07 \text{ pu}$$

$$Z_{34} = 0.05 + j0.07 \text{ pu}$$

All quantities are in per unit on 20 kV, 100 MVA base

(C.O.No.4) [Comprehension]