

**School of Electrical, Electronics and Communication Engineering**

**Course Code : BEEE4001**

**Course Name: Smart Grid and Energy Mngement**

# **UNIT III**

# **Cyber Security**

**GALGOTIAS  
UNIVERSITY**

**Name of the Faculty: Dr. Shagufta Khan**

**Program Name: B.Tech**

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## SMART GRID

### Definition:

A smart grid uses digital technology to improve reliability, security, and efficiency (both economic and energy) of the electric system from large generation, through the delivery systems to electricity consumers and a growing number of distributed-generation and storage resources.

Smart Grid = Power Grid + Information and Communication Technologies (ICT)

### Understanding Smart Grid –

- System (G, T, D) with an advanced two-way communications system
- Enables real-time monitoring and control
- Enables cost reduction and efficiency improvement

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## *Why Smart Grid*

**Growing population in Urban areas - nearly 70% of world population will live in cities by 2050.**

**80% of Global Energy consumption in Cities.**

**High AT&C Losses and High Outage rates.**

**50% of world Green house Gas Emission in cities.**

**Consumer aspiration for fast and professional services in affordable way.**

**Better management of Depleting Natural resources.**

**Cities to be competitive and sustainable to make it Smarter, effective and livable.**

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## INFORMATION AND COMMUNICATION TECHNOLOGY

- ICT are core of a successful smart grid implementation.
- Using ICT , the grid become more reliability, security, and efficiency.
- Systems (G,T,D), consumption, marketing , retailing , etc. are heavily based on ICT infrastructures.

### FUNCTION OF ICT

#### 1. Generation domain -

- Automation of Bulk generation and Distributed energy resource (DER) operations.
- Synchronizing and adjusting the voltage levels.

#### 2. Transmission domain –

- Automation of the transmission power grid (SCADA/EMS)

#### 3. Distribution domain -

- Distributed management system (DMS) improves classical Outage Management Systems (OMS) by automation.
- Real-time adjustments by Advanced Distribution Automation

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## Smart Grid Cyber Security

- IT technologies can make the grid *smart*!
  - **Real time monitoring** (PMUs, Smart Meters)
  - **Advanced information analysis** (Big Data)
  - **Automated control** (Self-healing, Smart Actuators)
- They also make the grid *vulnerable*!

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## SECURITY OBJECTIVES OF SMART GRID

- **Data Availability:** Refers to the timely and reliable access to the use of information.
- **Data Confidentiality:** It refers to protecting personal privacy and proprietary information from unauthorized access.
- **Data Integrity:** It refers to preventing or detecting the modification of information by unauthorized persons or systems.

THE MAXIMUM DELAY	COMMUNICATION TYPE
$\leq 4$ Millisecond	Relays Protection
Sub second	Wide area system monitoring
Second	Substation and branch monitoring and SCADA
Minute	Non-critical equipment and market price information monitoring
Hour	Meter reading and long-term price information
$\geq$ Day	Long term use of the data collected

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- Smart grid back bone is its computer network, which connect different components to a smart grid, and provide two way communication.
- Network components are increases ,the complexity of power system is also increases which brings more opportunities to security vulnerabilities.

## POTENTIAL RISKS ASSOCIATED WITH CYBER SYSTEM

- Increased complexity
- Risk of cascading failures
- Increase in potential adversaries
- Data privacy issues

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## TYPES OF ATTACK

### 1. Denial-of-service attack :

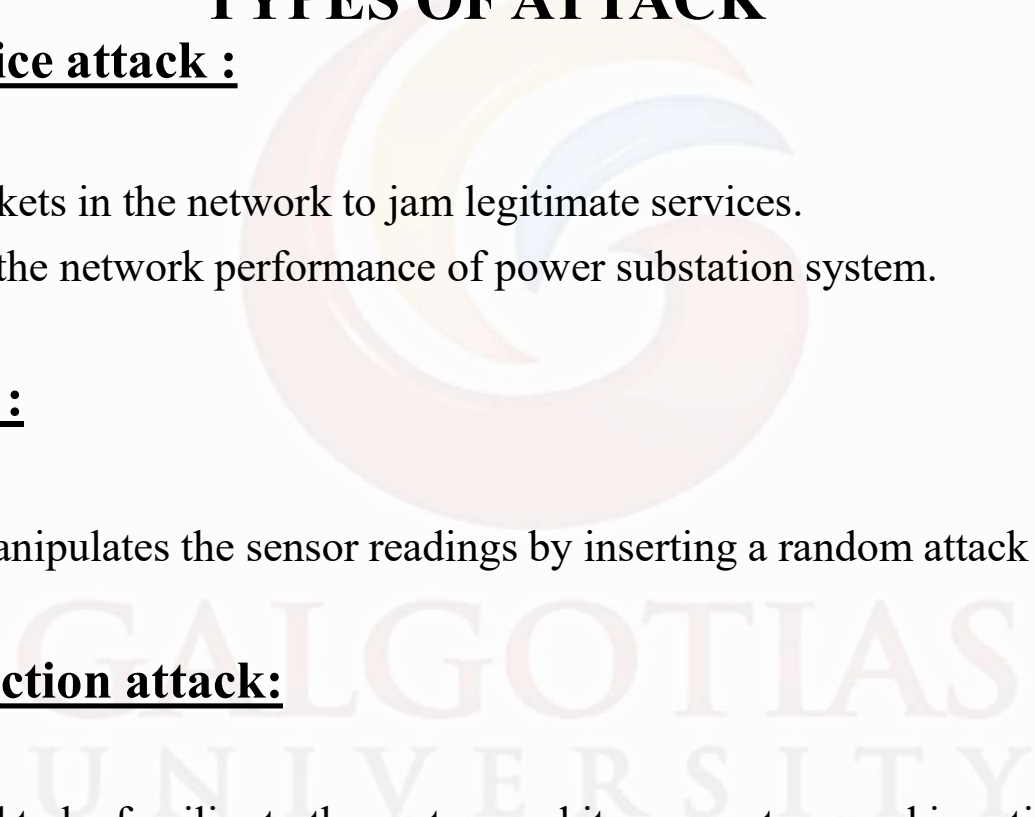
- Attacker floods packets in the network to jam legitimate services.
- It leads to damage the network performance of power substation system.

### 2. Random attack :

- Attacker simply manipulates the sensor readings by inserting a random attack vector.

### 3. False data injection attack:

- Attacker is assumed to be familiar to the system and its parameters used in estimation and detection.



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