

## **MTPA – 401 DATA CENTER DESIGN & OPERATION**

### **UNIT I**

Need of computer control of power systems, concept of energy control center (or) load dispatch center and the functions, system monitoring, data acquisition and control, system hardware configuration, SCADA and EMS functions, network topology, state estimation, security analysis and control, operating states.

### **UNIT II**

Data Center Design- Basic philosophy of data center design, flexibility, scalability, modular design, space relationships, Data Center architecture and topology, raised flooring , physical layer design and network cabling, Cooling consideration, air management, cold and hot aisle arrangement, flexible barriers, ventilated racks, benchmarking, airside economizers, cooling plant optimization, humidification control, computation of air-conditioning requirements,

### **UNIT III**

Power Supply- UPS requirement and battery backups, UPS Efficiency, DG sets, Electrical layout of data center Energy Efficiency of Data Center.

### **UNIT IV**

Data Center hardware- Servers, Storage, networking devices, switches and routers  
Data Center operation- NOC room, BMS

### **UNIT V**

Data exchange with Billing system (Data centre & DR centre) ,Data Exchange with customer care system under R-APDRP IT Implantation, Data Exchange with GIS System, Historical Information (HI) Data Retrieval, System Message Log Storage and Retrieval, Mass Storage of Data / Files, Data Recovery Function (DR)

### **Reference Books:-**

1. 'Data Center Design,' from the book Administering Data Centers: Servers, Storage, and Voice over IP by Kailash Jayaswal, courtesy of Wiley Publishing.
- 2.Scada: Supervisory Control And Data Acquisition, by Staurt A. Boyer
3. Data Center Virtualization Fundamentals: by Gustavo A. A. Santana

## **MTPA-402 SCADA SYSTEMS**

### **UNIT-I**

**SCADA SYSTEM:** Need of computer control of power systems, Data acquisition and control, SCADA System evolution, SCADA System architecture, SCADA System desirable properties, Remote Terminal Unit- RTU Principle, Test and configuration tools for RTU, SCADA human – machine interface (HMI)

### **UNIT-II**

**SCADA COMMUNICATION** - Transducers- Analog and Digital transducers, Digital data acquisition systems, Signal conditioning system, Data telemetry- Voltage and current telemetry, Position telemetry , radio frequency telemetry, Transmission channels and media

### **UNIT-III**

**SCADA Protocols-** Evolution of SCADA Protocols, Proprietary and open protocols , OSI Model, TCP/IP Model, Modbus, DNP3, UCA, IEC 61850 Standards, SCADA security system

### **UNIT- IV**

**Automatic Substation Control and Distribution Automation** : Topology and functionality, hardware implementation , system configuration and testing, Factors influencing the application of automation of distribution networks, Primary and secondary distribution network automation, Autoreclosers , Sectionalizers , Ring Main Units (RMU) ,Fault passage Indicators (FPI)

### **UNIT-V**

**Smart Grid-** Principle and architecture of Smart Grid, Self healing and adaptive grids, Key drivers, components of smart grid, smart grid management center, Advance metering infrastructure for smart grid , Zigbee and home area network (HAN), Phasor measurement unit (PMU), smart grid security , India's initiative and development toward smart grid , challenges in smart grid implementation.

#### **Reference Books :-**

1. SCADA: Supervisory Control and Data Acquisition - Stuart A. Boyer , ISA publisher
2. Practical Modern SCADA Protocols-Gordon Clarke and Deon Reynders, Newnes publisher
3. Cybersecurity for SCADA Systems-William T Shaw , PennWell Books
4. GIS - SCADA Integration: Approach for Power Distribution-Priyanka Verma and Sumit Verma , LAP Lambert Academic Publishing
5. Securing SCADA Systems-Ronald L. Krutz, John Wiley & Sons
6. Designing SCADA Application Software-Stuart G. McCrady, Elsevier Science Publishing Co Inc
7. Control and Automation of Electrical Power Distribution Systems- James Northcote-Green and Robert G. Wilson , CRC Press
8. Smart Grid Fundamentals of design and analysis - James Momoh, Wiley-Blackwell publisher