MTPA – 201 REACTIVE POWER CONTROL & FACTS

UNIT 1

Description and definition of Introduction to FACTS: Basic Types of ccontrollers – Benefits from FACTS technology- Static Var Compensator (SVC): Principle of operation, configuration and control. Thyristor Controlled Series compensator (TCSC): Principle of operation, configuration and control, Application for damping electromechanical Oscillations, Application for mitigation of SSR. Static Compensator (STATCOM): Principle of operation, configuration and control. Static Synchronous Series Compensator (SSSC): Principle of operation, configuration and control. Thyristor Controlled Phase Angle Regulator (TCPAR): Principle of operation, configuration and control, Unified Power Flow Controller (UPFC): Principle of operation, configuration and control, Simulation of UPFC, Steady state model of UPFC. Interline Power Flow Controller (IPFC): Principle of operation, configuration and control.

UNIT 2

Oscillation Stability Analysis and Control: Introduction – Linearised model of power systems installed with FACTS based Stabilisers – Heffron-Phillips model of a SMIB system installed with SVC, TCSC and TCPS – Heffron-Phillips model of a SMIB system with UPFC – Heffron-Phillips model of a Multi-machine system installed with SVC, TCSC and TCPS

UNIT 3

Analysis and Design of FACTS based stabilisers: Analysis of damping torque contribution by FACTS based stabilisers installed in SMIB systems, Design of robust FACTS based stabilisers installed in SMIB systems by phase compensation method. Selection of installing locations and feed back signal for FACTS based stabilizers

UNIT 4

Transient Stability control with FACTS: Introduction – Analysis of Power systems installed with FACTS devices: Power transmission control using Controllable Series Compensation(CSC), Power Transmission Control using SSSC, Power Transmission Control using UPFC, Power Transmission Control using Phase Shifting Transformer(PST), Power Transmission Control using UPFC, Control of FACTS devices for transient stability improvement – General considerations of FACTS control strategy: CSC,SSSC, SVC, STATCOM and UPFC control strategy – General Structure of the FACTS devices control.

References:
1. Reactive Power Control in Power Systems, T J E Miller John Wiley.
2. Computer modeling of Electrical Power Systems, J Arriliga, N R Watson, Wiley
3. Understanding FACTS' N G Hingorani and L Gyugyi, IEEE Press.
4. Flexible ac Transmission Systems (FACTS), Y.H. Song, A.T.Johns,IEEE P.

MTPA – 202 COMPUTER NETWORK & CYBER SECURITY

UNIT I

Introduction to Network Security, Computer Security and Cyber Security. Security Terminologies and Principle, Security Threats, Types of attacks (Operating System, application level, Shrink Wrap code, Misconfiguration attacks etc.). Introduction to Intrusion, Terminologies, Intrusion Detection System (IDS), Types of Intrusion Detection Systems, System Integrity Verifiers (SIVS).Indication of Intrusion: System Indications, File System Indications Network Indications. Intrusion Detection Tools ,Post attack IDS Measures & Evading IDS Systems. Penetration Testing, Categories of security assessments, Vulnerability Assessment, Types of Penetration Testing. Risk Management.

UNIT II

Cryptography, Classical Cryptographic Techniques, Encryption, Decryption, Code Breaking: Methodologies, Cryptanalysis, Cryptography Attacks, Brute-Force Attack, Use of Cryptography. Public key cryptography, Principles of Public key Cryptosystems, Cryptographic Algorithms RSA, Data Encryption Standard (DES), RC4, RC5, RC6, Blowfish, Key Management, Diffie-Hellman key exchange, elliptic curve cryptography.

UNIT III

Hash Functions, One-way Hash Functions, SHA (Secure Hash Algorithm), Authentication Requirements, Authentication Functions, Kerberos. Message Authentication codes, Message Digest Functions, MD5, SSL (Secure Sockets Layer), SSH (Secure Shell), Algorithms and Security, Disk Encryption, Government Access to Keys (GAK)
Digital Signature: Analysis, Components, Method, Applications, Standard, Algorithm: Signature Generation/Verification, ECDSA, EIgamal Signature Scheme, Digital Certificates.

UNIT IV

Trojans and Backdoors: Overt and Covert Channels, Working, Types (Remote Access Trojans, Data-Sending Trojans, Destructive Trojans, Trojans, Proxy Trojans, FTP Trojans, Security Software Disablers).
Viruses and Worms: Characteristics, Working, Infection Phase, Attack Phase. Sniffers:
Definition, spoofing, Sniffing, Vulnerable Protocols, Types.
Phishing: Methods, Process, Attacks Types (Man-in-the-Middle Attacks, URL Obfuscation Attacks, Hidden Attacks, Client-side Vulnerabilities, Deceptive Phishing, Malware-Based Phishing, DNSBased Phishing, Content-Injection Phishing, Search Engine Phishing).
Web Application Security- Secured authentication mechanism, secured session management, Cross-site Scripting, SQL Injection and other vulnerabilities
Denial-of Service Attacks: Types of Attacks (Smurf Attack, Buffer Overflow Attack, Ping of Death Attack, Teardrop Attack, SYN Attack, SYN Flooding), DDoS Attack(Distributed DoS Attack.), Session Hijacking, Spoofing v Hijacking, TCP/IP hijacking, CAPTCHA Protection

UNIT V

IP Security, Web Security, Firewalls: Types, Operation, Design Principles, Trusted Systems. Computer Forensics, Need, Objectives, Stages & Steps of Forensic Investigation in Tracking Cyber Criminals, Incident Handling.
Hacking, Classes of Hacker (Black hats, grey hats, white hats, suicide hackers), Footprinting, Scanning (Types-Port, Network, Vulnerability), E-Mail Spiders, Overview of System Hacking Cycle.

w.e.f. July-2013

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Suggested Reading:

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Pearson
2. Charlie Kaufman, Radia Perlman, Mike Speciner, Michael Speciner, " Network Security -Private communication in a public world" TMH
3. Fourozon, "Cryptography & Network Security" TMH
4. Joseph Migga Kizza, Computer Network Security, , Springer International Edition
5. Atul Kahate,"Cryptography and Network Security" Mc Graw Hill
6. Carl Endorf, Eugene Schultz, Jim Mellander **"INTRUSION DETECTION & PREVENSION"** TMH
7. Neal, Krawetz, Introduction to Network Security,Cengage Learning

MTPA – 203 ADVANCED COMPUTER METHODS IN POWER SYSTEMS

Unit I
Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line laudability, capability curves of alternator.

Unit II
Control of load bus voltage using reactive power control variable, SVC & SVS, Regulated shunt compensation, series and shunt compensation, Uniform series and shunt compensation and effect on load ability of transmission lines.

Unit III
Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.

Unit IV
Power system security – Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and post-contingency, corrective rescheduling.

Unit V
Voltage stability - Difference between voltage and angle stability, PV Curve for voltage stability assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability , effect of load models.

References:
.Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc.1984.
Computer methods in power systems analysis – by stage G.W. and E.L. Abiad A.H. Mc Graw Hill.Computer
Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley & Son
Computer Aided Power Systems Analysis Kusic G.L.- 2nd Edition, CRC Press
 Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill.
Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill.
Power System Stability and control –P Kundur ,IEEE Press 1994.
Advance Power Systems Analysis and Dynamics Singh L.P. John Wiley.

MTPA – 204 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-205 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