EXC-801- Power quality Problems and mitigation Techniques

UNIT-I

Introduction, power quality -voltage quality, power quality evaluations procedures term and definition: general classes of power quality problem, causes & effect of power quality disturbances.

UNIT-II

Loads that causes power quality problems, State of art on Passive shunt and series compensation, Classification and working of passive shunt and series compensation, Classification, Principle and control of active shunt compensator: DSTATCOM, Active series compensators, working and its control.

UNIT-III

Introduction to unified power quality compensators, classification, working and operation of UPQC.

UNIT-IV

Voltage sags and interruption: sources of sags and interruption, estimating voltages sag performance, fundamental principles of protection, monitoring sags. Transients over voltages: sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients, fundamentals of harmonics and harmonics distortion, harmonics sources from commercial load and from industrial loads.

UNIT-V

Applied harmonics: harmonics distortion evaluations, principles for controlling harmonics, harmonics studies devices for controlling harmonic distortion, Shunt active and passive filters, their operation and control.

Reference Books:

Power Quality- by R.C. Duggan 2
Power System harmonics –by A.J. Arrillga
Power electronic converter harmonics –by Derek A. Paice
Power quality problems and mitigation techniques: Bhim singh, Amrish Chandra, Kamal Al- Haddad.

List of experiments:

1. Simulation showing the effect of power quality problems.
2. Simulation of reactive power compensation of linear load.
3. Simulation of harmonic analysis of balanced non-linear loads.
4. Simulation of harmonic analysis of un-balanced non-linear loads.
5. Simulation of active shunt filters for harmonics compensation.
6. Simulation of compensation device showing power factor correction.
7. Simulation of compensation device showing voltage regulation.
8. Simulation of hybrid filter as a combination of active series and passive shunt filters.
9. Simulate the effect of neutral current.
10. Simulate the effect of dynamic load connected to 3-phase system.

EXC-802 Asynchronous Machines

UNIT- I

Stepper Motors: Discretisation of angular position by stepper structures, stepping angle and frequency of excitation. VR and PM rotor structures and their torque production, torque angle characteristics. The hybrid structure and torque production by permanent magnet and excitation fluxes. Power electronic converters for stepper motors, control by load angle.

UNIT - II

Switched reluctance motor, static torque production, partition of energy and the effects of saturation, Dynamic torque production, torque speed characteristics, shaft position sensing, solid rotors.

UNIT- III

BrushLess DC Motor construction and principle, speed control, basic concept of torque, outer and inner rotor, magnetic circuit concept, electrical analogy, winding pattern series and parallel, Thermal consideration.

UNIT- IV

Permanent magnet materials and circuits; Characteristics, parameters, properties, classification and calculations, Permanent magnet motors, D.C. brushed motors, design analysis and control and applications.

UNIT- V

PM synchronous motors, rotor construction, theory, operation, control and applications. PM step motors, hybrid step motors, sensorless control, reduction of torque pulsations; Case studies such electric vehicles, industrial drives, PV fed water pumping.

Reference Books:

1. Brushless Permanent Magnet & Reluctance Motor Drives – T.J.E.Miller

2. Principles of Electric Machines & Power Electronics – P.C.Sen 3.

3. Electric Drives – G.K.Dubey

 4. Permanent magnet synchronous & brushless DC motor drives- R Krishnan, CRCPress, 2004

List of experiments:
    Experiment will be above content

EXC-803 (A) EHVAC/DC Transmission

Unit-I

Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. Transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. Transmission, Power handling capacity. Converter analysis garetz circuit, Firing angle control, Overlapping.

Unit-II

FACTS devices, basic types of controller, series controller, static synchronous series compensator (SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit-III

Components of EHV d.c. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

Unit-IV

Control of EHV d.c. system desired features of control, control characteristics, Constant current control, Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Unit-V

Travelling waves on transmission systems, Their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

Reference:
1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", john willy & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.

EXC-803 (B) Power Generation and Economic

UNIT -I
Power System Fundamentals Regulation and Deregulation, condition for deregulation, problems with regulation, risk management,
congestion management, ATC, screening curve.

UNIT-II
Competitions in Power Market What is competition, efficiency of perfect competition, marginal cost in power market, role of marginal cost,
working with marginal cost, results of marginal cost.

UNIT-III
Market Power And Structure Define market power, price quality outcomes, three stages of market power, using price quality outcomes to show power, monopoly in power auction, market power on demand side.

UNIT-IV
Restructure Fundamental restructure system, transmission pricing, restructure models, OASIS, structure of OASIS, transfer capability of OASIS.

UNIT -V
Designing And Testing Market Rules Design for competitive prices, testing of market design, designing to reduce market power.

REFERENCES:
1- Power system economics-designing for electricity-steven stoft. (IEEE press & WILEYINTERSCIENCE).
2- Electric Power Systems weedy,cory, wily india 2nd edition

EXC-803 (C) Advance Power Electronics

UNIT- I
Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement. Device selection, Control circuits. Switch mode power supplies, Square wave switching, Resonant mode operation of Power supplies , Ferroresonant, Linears and the switchers.

UNIT- II
DC to DC Converters: Analysis and design of buck, boost, buck-boost and cuk converters, two quadrant and full bridge converters. Isolated converters i.e., flyback, forward and bridge topology. Design of d.c. inductor. Concept of integrated magnetics, converter control, averaged model, statespace
model.

UNIT- III
DC to Controlled AC: Controlled inversion, three phase full bridge inverters. 180□ mode and 120□ mode operation, harmonic analysis, PWM control of VSI, current mode control of PWM VSI, space vector modulation, three phase current sourced PWM CSI,

UNIT- IV
AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern,

UNIT- V
Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switching cell, ZCT and ZVT DC converters,

Text Books:
1. "Power Electronics Circuits", Issa Batarseh, John Wiley & Sons Inc., 2004.
2. "Power Electronics: ", L.Umanad, Wiley India.
3. "Power Electronics: Converters, Applications, and Design", Ned Mohan, John Wiley & Sons Inc., 2001.
4. "Power Electronics: Devices and Circuits", Jagannathan, PHI Learning 2012

Reference Books:
1. "Power Electronic Systems Theory and Design", Jai P Agrawal, Pearson Education Asia, 2001.
2. "Switching Power Supply Design", A I Pressman, McGraw Hill Publication, 1991.
3. "Handbook of Power Electronics", M H Rashid

EXC-804 (A) SCADA Systems And Applications

UNIT I
Introduction to SCADA and PLC:SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

UNIT II
SCADA system components: Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

UNIT III
SCADA Architecture-Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

UNIT IV
SCADA Communication-Various industrial communication technologies- wired and wireless methods and fiber optics, open standard communication protocols.

UNIT V
Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation,SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

Reference Books:

1. Stuart A Boyer: SCADA supervisory control and data acquisition.

2. Gordan Clark, Deem Reynders, Practical Modem SCADA Protocols.

3. Sunil S. Rao, Switchgear and Protections, Khanna Publication.

EXC-804 (B) Objected Oriented Methodologies C & C++

UNIT-I

Fundamentals of C Programming: History of C; Structure of a C Program; Data types; Constant & Variable, naming variables; Operators & expressions; Control Constructs – if-else, for, while, do-while; Case switch statement; Arrays; Formatted & unformatted I/O; Type modifiers & storage classes; Ternary operator; Type conversion & type casting; Priority & associativity of operators.

UNIT-II

Modular Programming: Functions; Arguments; Return value; Parameter passing – call by value, call by reference; Return statement; Scope, visibility and life-time rules for various types of variable, static variable; Calling a function; Recursion – basics, comparison with iteration, types of recursion- direct, indirect, tree and tail recursion, when to avoid recursion, examples.

UNIT – III

Advanced Programming Techniques: Special constructs – Break, continue, exit(), goto & labels; Pointers - & and * operators, pointer expression, pointer arithmetic, dynamic memory management functions like malloc(), calloc(), free(); String; Pointer v/s array; Pointer to pointer; Array of pointer & its limitation; Function returning pointers; Pointer to function, Function as parameter; Structure – basic, declaration, membership operator, pointer to structure, referential operator, self-referential structures, structure within structure, array in structure, array of structures; Union – basic, declaration; Enumerated data type; Typedef; command line arguments. Miscellaneous Features: File handling and related functions; printf & scanf family;C preprocessor – basics, #Include, #define, #undef, conditional compilation directive like #if, #else, #elif, #endif, #ifdef and #ifndef; Variable argument list functions.

UNIT-IV

C++ basics, loops and decisions, structures and functions, object and classes, object arrays, constructor and destructor functions. Operator and function overloading, pointers, pointers to base and derived classes inheritance, public and private inheritance, multiple inheritance.

UNIT-V

Polymorphism, virtual functions, abstract base classes and pure virtual function, friend function, early and late binding. C++ I/O system, formatted I/O, creating insertors and extractors, file I/O basis, creating disk files and file manipulations using seekg(), seekp(), tellg() and tellp() functions, exception handling: try, catch and throw.

BOOKS:

1. Kerninghan & Ritchie "The C programming language", PHI
2. Schildt "C:The Complete reference" 4th ed TMH.
3. Cooper Mullish "The Spirit of C", Jaico Publishing House, Delhi
4. Kanetkar Y. "Let us C", BPB.

5. Kanetkar Y.: "Pointers in C" , BPB

6. Gottfried : "Problem Solving in C", Schaum Series

7. Jones, Harrow Brooklish "C Programming with Problem Solving", Wiley Dreamtech India. Note : Paper is to be set unit wise with internal choice.

8. Lafore R. "Object Oriented Programming in C++", Galgotia Pub.

9. Lee "UML & C++ a practical guide to Object Oriented Development 2 ed, Pearson.

10. Schildt "C++ the complete reference 4ed, 2003.

11. Hans Erit Eriksson "UML 2 toolkit" Wiley.

12. Balagurusawmy "Object Orienter Programming with C++".

13. B.G., Boach "Object Oriented Analysis & Design with Applications", Addision Wesly.

14. S. Parate "C++ Programming", BPB. 8. Boggs "Mastering UML" BPB Publications.

EXC-804 (C) VLSI circuits and systems

UNIT I

Introduction to CMOS VLSI circuit, VLSI design flow, Design strategies ,Hierarachy, regularity, modularity, locality, MOS Transistor as a Switches, CMOS Logic, Combinational circuit, latches and register, Introduction of CAD Tool , Design entry, synthesis, functional simulation.

UNIT- II

Specification of sequential systems Characterizing equation & definition of synchronous sequential machines. Realization of state diagram and state table from verbal description, Mealy and Moore model machines state table and transition diagram. Minimization of the state table of completely and incompletely specified sequential machines.

UNIT III

Asynchronous Sequential Machine Introduction to asynchronous sequential machine, Fundamental mode and Pulse mode asynchronous sequential machine, Secondary state assignments in asynchronous sequential machine, races and hazards.

UNIT IV

State Machine Algorithmic state machine and fundamental concept of hardware/ firmware algorithms. Controllers and data system designing.

UNIT V

Fault Detection in combinational circuit Types of faults, Fault detection using Boolean Difference and path sensitization method. Concept of PROM, PLA, PAL, CPLD and FPGA, PALASM software applications.

Refrences:

1. Neil Weste: Principle of CMOS VLSI Design, TMH.

2. Kohavi: Switching & Finite Automata Theory, TMH.

3. Lee: Digital Circuits and Logic Design, PHI Learning..

4. Roth Jr.: Fundamentals of Logic Design, Jaico Publishing House.

5. Parag K. Lala: Fault Tolerant and Fault Testable Hardware Design, BS Publication.

EXC-805 (A) Power Electronics Converters for Renewable Energy

UNIT- I
Introduction to renewable sources: world energy scenario, Wind, solar, hydro, geothermal, availability and power extraction. Introduction to solar energy: Photovoltaic effect, basics of power generation, P-V & I-V characteristics, effect of insolation, temperature, shading; Modules, connections, ratings; Power extraction (MPP), tracking and MPPT schemes; standalone systems, grid interface, storage, AC-DC loads.

UNIT-II
Power converters for solar: Micro converter, DC-DC buck/boost/buck-boost /flyback /forward/cuk, bidirectional converters; Inverters: 1ph, 3ph inverters Multilevel Neutral point clamp, Modular multilevel, CSI; Control schemes: unipolar, bipolar.

UNIT- III
Single phase and three-phase back Controllers. Triggering techniques for power factor and harmonic controls. Design and analysis of phase control circuits. Solid state transfer switches. Concept of three-phase to single phase and single phase to three-phase cyclo-converter. Effect of source inductance. Concept of PWM techniques single and multiple pulse form. Working of STATCON, SVC, UPS, SMPS.

UNIT- IV
Intro to wind energy: P-V, I-V characteristic, wind power system: turbine-generator-inverter, mechanical control, ratings; Power extraction (MPP) and MPPT schemes. PLL and synchronization, power balancing / bypass, Parallel power processing; Grid connection issues: leakage current, Islanding mode, harmonics, Mitigation of harmonics, filters, passive filters, Active filters, active/reactive power feeding, unbalance.

UNIT-V
Generators for wind: DC generator with DC to AC converters; Induction generator with & w/o converter; Synchronous generator with back to back controlled/ uncontrolled converter; Doubly fed induction generator with rotor side converter topologies; permanent magnet based generators. Battery: Types, charging discharging.

References:
1. Sudipta Chakraborty, Marcelo G. Sim303265es, and William E. Kramer. Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Chetan Singh Solanki, Solar Photovoltaics: fundamentals, Technologies and Applications, Prentice Hall of India, 2011.
2. N. Mohan, T.M. Undeland & W.P. Robbins, Power Electronics: Converter, Applications & Design, John Wiley & Sons, 1989
3. Muhammad H. Rashid, Power Electronics: Circuits, Devices, and Applications, Pearson Education India, 2004.
4. Topologies, Control and Integration. Springer Science & Business, 2013. 5. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd., 2011.

EXC-805 (B) Environmental Issues, Policy, Standards & Regulations

UNIT I
Global environmental concerns: The Scenario, The Changing Global atmosphere &common concerns. United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Various Clean Development Mechanism (CDM), Prototype Carbon fund (PCF), Earth Summit, Sustainable development. Green Certificate

UNIT-II
The Global Program for protected area management, Strategies for environmental improvement plan. Organizations working in the field of energy and environment - UNEP, IPCCC, CPCB etc. Basic features of ISO 14000.

UNIT-III
Water Quality: Parameters: Physical, Chemical and Bacteriological .Potable Water Standards,Waste Waster Effluent Standards. Minimal National Standards (MINAS).

UNIT -IV
Environment Policies: Water Act 1974, The Air Act, 1981, Environmental (Protection) Act.- 1986, M. P. State Environment Policy, Municipal Solid Waste (Management & Handling) Rules, 1998, Biomedical Waste (Management & Handling) Rules 1998.

UNIT-V
Review of various energy sources. Importance of unconventional sources such as solar, biogas, wind, tidal etc. Study of typical energy converters such as high performance motors, special generators driven by biogas engines, wind turbines etc. Mini-hydro generators. Modern state-ofthe art and futuristic systems in this area.

References:

1. Environmental Issues and Polices, Prentice Hall—Stephon Ison, Stephen Peake, Stuart Wall
2. ISO 14000 Environmental Management by Goetsch, Davis. Prentice Hall
3. Standard methods for the Examination of Water and Wastewater. (1989).17thEd. APHA, Washigton. D.C., 2-12
4. Energy Management by Paul O'Callaghan –McGraw Hill
5. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
6. Training material on 'Environmental concerns' prepared by National Productivity Council
7. Parivesh, October 2002 – Central Pollution Control Board.

EXC-805 (C) Estimating and Costing

UNIT- I
Introduction :Purpose of estimating and costing, proforma for making estimates, preparation of materials schedule costing, price list, tender document net price list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills, tenders, its constituents, finalization specimen tender.

UNIT- II
Types of wiring: Electrical, batten, casing-casing and conduit wiring, comparison of different wiring, selection and design of wiring schemes for particular situation (domestic and industrial). selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc, use of wire-gauge and tables.

UNIT- III
Estimating and Costing: Domestic installations, planning of circuits, sub-circuits electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (single storey and multi-storey buildings), industrial installations, relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of materials lists, estimating and costing exercises on workshop with singe-phase, 3-phase motor load and the light load (3-phase supply system), service line connection estimate for domestic and industrial loads (over-head and under ground connections) from pole to energy meter, different types of fans and their sizes, air-conditioners, exhaust fans, determination of size and number of fans for a given situation.

UNIT- IV
Transmission and distribution lines: (overhead and underground) planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations. U

UNIT- V
Substation: Types of substations, layout of substations, substation schemes and components, estimate of 11/0.4 KV pole mounted substation up to 200 KVA rating.

References:

1. Electrical Estimating and Costing by JB Gupta, Satya Prakashan, New Delhi
2. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi
3. Estimating and Costing by by Surjeet Singh, Dhanpat Rai & Co., New Delhi
4. Estimating and Costing by Qurashi
5. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi
6. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi

EXC- 806 INDUSTRIAL TRAINING PROJECT-II

The focus of the Industrial Training Project-II is on preparing a working system or some design or Understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).