PEL6I102 POWER SYSTEM OPERATION & CONTROL

Module – I **(14 Hours)**
University Portion (80%) **(12 hours)**

Fundamentals of Power System **(Book No.1, Ch. 1)**
Introduction, Single Subscript Notation, Double Subscript Notation, Power in Single Phase AC Circuit, Complex Power, The Power Triangle, Direction of Power Flow, Voltage and Current in Balanced Three Phase Circuits, Power in Balanced Three Phase Circuits, Per- Unit Quantities, Changing the Base in Per- Unit Quantities, Node Equations, The Single Line or One Line Diagram, Impedance and Reactance Diagrams. (**Book-1:Ch. 1.1, Ch. 1.2, Ch. 1.3, Ch. 1.4, Ch. 1.5, Ch. 1.6, Ch. 1.7, Ch. 1.8, Ch. 1.9, Ch. 1.10, Ch. 1.11, Ch. 1.12, Ch. 1.13, Ch. 1.14).**
The Admittance Models & Network Calculations **(Book – 1: Ch. 7 (7.1 To 7.5))**
Branch and Node Admittances, Mutually Coupled Branches in Ybus, an Equivalent Admittance Network, Modification of Ybus, the Network Incidence Matrix and Ybus. (**Book-1:Ch. 7.1, Ch. 7.2, Ch. 7.3, Ch. 7.4, Ch. 7.5.)**
Power Flow Solutions **(Book – 1, Ch. 9)**
The Power-Flow Problem, the Gauss-Seidal Method, the Newton-Raphson Method, the Newton-Raphson Method, Power-Flow Studies in System Design and Operation, Regulating Transformers, the Decoupled Method. (**Book-1:Ch. 9.1, Ch. 9.2, Ch. 9.3, Ch. 9.4, Ch. 9.5, Ch. 9.6, Ch. 9.7.)**
College/Institute Portion (20%) **(2 hours)**
Power system structure: (**Reference 1: 1.1, 1.2, 1.3,)** Power factor correction, three phase loads, delta to star transformation: (**Reference1: 2.5, 2.8, 2.9, 2.10, 2.11)** Or related advanced topics as decided by the concerned faculty teaching the subject.

Module – II **(14 Hours)**
University Portion (80%) **(12 hours)**

Economic Operation of Power System **(Book – 1, Ch.13)**
Distribution of Load between Units within a Plant, Distribution of Load between Plants, The Transmission-Loss Equation, An interpretation of Transformation **C**, Classical Economic Dispatch with Losses, Automatic Generation Control, Unit Commitment, Solving the Unit Commitment Problems.
(Book-1: Ch. 13.1, Ch. 13.2, Ch. 13.3, Ch. 13.4, Ch. 13.5, Ch. 13.6, Ch. 13.7, Ch. 13.8.)
Load Frequency Control, Control Area Concept **(Book – 2, Ch.9)**
Automatic Load-Frequency Control of Single Area Systems: Speed-Governing System, Hydraulic Valve Actuator, Turbine-Generator Response, Static Performance of Speed Governor, Closing the ALFC Loop, Concept of Control Area, Static Response of Primary ALFC Loop, Dynamic Response of ALFC Loop, Physical Interpretation of Results, The Secondary ("Reset") ALFC Loop, Economic Dispatch Control. (**Book – 2: Ch. 9.3.1, Ch. 9.3.2, Ch. 9.3.3,Ch. 9.3.1, Ch. 9.3.4, Ch. 9.3.5, Ch. 9.3.6, Ch. 9.3.7, Ch. 9.3.8, Ch. 9.3.9, Ch. 9.3.10, Ch. 9.3.11.)**
College/Institute Portion (20%) **(2 hours)**
Load frequency control: **(Reference 1:12.3)** Or related advanced topics as decided by the concerned faculty teaching the subject.

Module – III **(6 Hours)**
University Portion (80%) **(4 hours)**

Two Area Systems **(Book – 2, Ch.9)**

ALFC of Multi-Control-Area Systems (Pool Operation): The Two Area Systems, Modeling the Tie-Line, Block Diagram Representation of Two Area System, Mechanical Analog of Two Area System, Dynamic Response of Two Area System, Static System Response, Tie-Line Bias Control of Multi-area Systems. (**Book – 2: Ch. 9.4.1, Ch. 9.4.2, Ch. 9.4.3 Ch. 9.4.1, Ch. 9.4.4, Ch. 9.4.5, Ch. 9.4.6, Ch. 9.4.7, Ch. 9.4.8, Ch. 9.4.9, Ch. 9.4.10.)**

College/Institute Portion (20%) (2 hours)

Tie line bias control: **(Reference 1: 12.4)** Or related advanced topics as decided by the concerned faculty teaching the subject.

MODULE IV (6 hours)

University Portion (80%) (4 hours)

Power System Stability **(Book-1, Ch.16)**

The Stability Problem, Rotor Dynamics and the Swing Equation, Further Considerations of the Swing Equations, The Power-Angle Equation, Synchronizing Power Coefficients, Equal-Area Criterion for Stability, Further Applications of the Equal-Area Criterion, Multi-machine Stability Studies: Classical Representation, Step-By-Step Solution of the Swing Curve, Computer Programs for Transient Stability Studies, Factors Affecting Transient Stability. (**Book-1:Ch. 16.1, Ch. 16.2, Ch. 16.3, Ch. 16.4, Ch. 16.5, Ch. 16.6, Ch. 16.7, Ch. 16.8, Ch. 16.9, Ch. 16.10, Ch. 16.11.)**

College/Institute Portion (20%) (2 hours)

Synchronous machine,Steady state stability, Transient Stability: (**Reference 1:11.3, 11.4, 11.5)** Or related advanced topics as decided by the concerned faculty teaching the subject.

Text Books:

1. *Power System Analysis- By John. J. Grainger & W. D. Stevenson, Jr., TMH, 2003 Edition, Fifteenth Reprint.*
2. *An Introduction to Electric Energy System Theory- By O. I. Elgerd, TMH, Second Edition.*
3. *Power System Analysis- By T. K. Nagsarkar & M. S. Sukhija, Oxford University Press.*

Reference:

1) *Power System Analysis- By Hadi Saadat, TMH, 2002 Edition, Eighth Reprint.*
2) *Power System Analysis Operation and Control- By A. Chakrabarti and S. Haldar, Third Edition, PHI Publications, 6th Reprint, 2010.*