

LNCT University
Diploma EX, V Semester Syllabus

POWER SYSTEM – II (DEX-503)

COURSE OUTCOMES:

After Completing the course student should be able to:

CO-1	Explain the need for protection in power systems and describe protection schemes for alternators, transformers, transmission lines and bus bars using CTs and PTs.
CO-2	Analyse different types of faults (symmetrical and unsymmetrical) and apply suitable protective schemes such as differential, overcurrent, earth fault, and distance protection.
CO-3	Compare the construction, working principles and applications of various types of circuit breakers (oil, air, SF ₆ , vacuum) and switchgear components.
CO-4	Interpret the concepts of power system stability and perform fault analysis using the per-unit system and short-circuit calculations for symmetrical faults.
CO-5	Demonstrate understanding of economic load dispatch. principles and analyse various tariff structures and power factor improvement methods for efficient power system operation.

UNIT I: PROTECTION OF POWER SYSTEM COMPONENTS

Necessity of protection in power systems, protection of alternators, transformers, transmission lines and bus bars, types of faults: symmetrical and unsymmetrical, use of CTs and PTs in protection, differential, over current, earth fault, and distance protection schemes.

UNIT II: CIRCUIT BREAKERS AND SWITCHGEAR

Functions and types of circuit breakers, operating principle of oil, air, SF₆ and vacuum circuit breakers, arc formation and arc extinction methods, rating of circuit breakers, types of switchgear: outdoor and indoor, switchgear components: isolators, fuses, surge arresters and earthing switches.

UNIT III: RELAYS

Introduction to protective relays, classification: electromagnetic, static and numerical relays, construction and working of over current, earth fault, differential and distance relays, relay coordination and setting, use of relays in transformer and motor protection.

UNIT IV: POWER SYSTEM STABILITY AND FAULT ANALYSIS

Steady state and transient stability, swing equation basics (qualitative), short-circuit analysis of symmetrical faults, per-unit system and fault level calculation, importance of system grounding.

UNIT V: ECONOMIC OPERATION AND LOAD DISPATCH

Load curve, load factor, diversity factor, and economic load dispatch: equal incremental cost criterion (qualitative), tariff types: flat rate, block rate, two-part tariff, maximum demand tariff, power factor improvement techniques.

List of Suggestive Experiments: -

1. Study of protection scheme for transformer using CTs and relays.
2. Study and testing of over current and earth fault relays.
5. Study of different types of circuit breakers (oil, air, SF₆, vacuum).
6. Demonstration of circuit breaker operation and timing test.
7. Identification and testing of switchgear components.
8. Study and characteristics of electromechanical relays.
9. Testing of static or numerical relays using relay test set.
10. Calculation of fault currents using per-unit system (manual/software).
11. Study of power factor improvement using capacitor bank.

Reference Books: -

1. Power System Protection and Switchgear, Badri Ram & D. N. Vishwakarma
2. Electrical Power Systems, C. L. Wadhwa
3. Switchgear and Protection, Sunil S. Rao
4. Modern Power System Analysis, D. P. Kothari & I. J. Nagrath
5. Power System Engineering V. K. Mehta & Rohit Mehta