

**PS5103 ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC
TRANSIENTS IN POWER SYSTEMS**

DETAILED SYLLABUS

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I REVIEW OF TRAVELLING WAVE PHENOMENA

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES

Lightning over voltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary over voltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III PARAMETERS AND MODELING OF OVERHEAD LINES

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors: equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α - β -0 transformation and symmetrical components transformation, modal impedances; analysis of modes on un transposed lines; effect of ground return and skin effect; transposition schemes; introduction to frequency-dependent line modeling.

UNIT IV PARAMETERS AND MODELING OF UNDERGROUND CABLES

Distinguishing features of underground cables: technical features, electrical parameters, overhead lines versus underground cables; cable types; series impedance and shunt admittance of single-core self-contained cables, impedance and admittance matrices for three phase system formed by three single-core self-contained cables; approximate formulas for cable parameters.

UNIT V COMPUTATION OF POWER SYSTEM TRANSIENTS

Digital computation of line parameters: why line parameter evaluation programs? Salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

REFERENCES

1 Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

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For Questions, Notes, Syllabus & Results

2 R. Ramanujam, "Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation", I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 Naidu M S and Kamaraju V, "High Voltage Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.