EE 532: STATISTICAL TECHNIQUES IN POWER APPARATUS (3-0-0: 3)

Introduction

Fundamental aspects of power apparatus and system, Classification and application of insulating materials in power equipments, Electrostatic field and dielectric properties, Gas, liquid, solid and composite insulation, generation and measurement of testing voltage, Non-destructive testing techniques.

Basic Concept of Statistical Techniques

Characterisation of a set of data – global statistical parameters, experimental (discrete) distribution, statistical functions (model).Estimation of population distribution – randomness test, confidence interval, distribution test.Suitability of statistical model.

Statistical Testing of Power Equipments

Estimation of measurement uncertainty.Power frequency and DC voltage test – voltage endurance test, intrinsic breakdown testand statistical evaluation of the breakdown strength.Impulse voltage testing – types of applied stress, test procedures (multi-level method, up and down method, extended up and down method), distribution of measured breakdown probabilities, weighting of the measured breakdownprobabilities.

Statistical Assessment of Insulators

Experimental aspects and statistical evaluation of breakdown probability in air, SF6 gas, transformer oil, ceramic/porcelain insulators and polymer insulators.Statistical analysis of partial discharge. Assessment of air insulated substation due to over voltage. Statistical methods for maintenance decision. Introduction to reliability centred maintenance.

Insulation Coordination

Classification and determination of voltages and overvoltages in power apparatus. Determination of coordination withstand voltage,statistical withstand voltage, standard withstand voltage.Surge arrestors in insulation coordination.

Life Prediction

Life distribution and stress life model.Types of accelerated test, accelerated life testing analysis, life prediction due to hostile environment, creep behaviour, fatigue behaviour, design of accelerated ageing test. Case study - statistical analysis of accelerated ageing experiment for XLPE cable and impregnated paper bushings.

Text Books & References:

1. W. Hauschild and W. Mosch, “Statistical Techniques for High Voltage Engineering”, IET, London, United Kingdom
2. F. A. M. Rizk and G. N. Trinh, “High Voltage Engineering”, CRC Press, Taylor & Francis Group
3. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering - Fundamentals”, Newnes Publisher
4. D. Kind and K. Freser, “High Voltage Test Techniques”, Newnes Publisher
5. M. Abdel-Salam, H. Anis, A. El-Morshed and R. Radwan, “High Voltage Engineering – Theory & Practice”, Marcel Dekker Inc.