**DECLARATION**

I hereby declare that I carried out the work reported in this thesis in the Department of Electrical and Information Engineering, School of Engineering and Technology, College of Science and Technology, Covenant University, Ota, Nigeria under the supervision of Prof. C.O.A. Awosope and Prof. J.C. Ekeh.

I also solemnly declare that no part of this report has been submitted here or elsewhere in a previous application for award of a degree. All sources of knowledge used have been duly acknowledged.

Engr. ADOGHE UWAKHONYE ANTHONY

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**CERTIFICATION**

This is to certify that this thesis is an original research work undertaken by **Anthony Uwakhonye ADOGHE** (CU05GP0125) and approved by:

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**DEDICATION**

This thesis is dedicated to God Almighty for his faithfulness and love towards me and to the service of Humanity.

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**LISTS OF SYMBOLS AND ABBREVIATIONS**

AENS Average energy not supplied per customer served

AI Artificial Intelligent

AM Asset Management

ANN Artificial Neural Network

ASAI Average Service Availability Index

CAIDI Customer Average Interruption Duration Index.

CAIFI Customer Average Interruption Frquency Index

CA Condition Assessment

CBM Condition Based Maintenance

CiGre International council on large electric systems

CM Corrective Maintenance

cm Condition Monitoring

CH4 Methane

C2H2 Acetylene

C2H4 Ethylene

C2H6 Ethane

CO Carbon monoxide

CO2 Carbon dioxide

DGA Dissolved gas analysis

DP Degree of polymerization

EPRI Electric Power Research Institute

FA Fura Analysis

FRA Frequency Response Analysis

HPP Homogeneous Poisson Process

HST Hot Spot temperature

HV High voltage

H2 Hydrogen

int. Interruption of voltage

LOE Average loss of energy

LTA Logic decision tree analysis

LV Low Voltage

MATLAB Matrix Laboratory

MC Monte Carlo

MM Maintenance Management

MTBF Mean Time Between Failures

MTTFF Mean Time To First Failure

MTTR Mean Time To Repair

MV Medium Voltage

NHPP Non – Homogeneous Poisson process.

PHCN Power Holding Company of Nigeria

PD Partial Discharge

PM Preventive Maintenance

RCM Reliability-Centered Maintenance

RMS Root mean Square value

SAIDI System Average Interruption Duration Index.

SAIFI System Average Interruption Frequency Index

UMIST: University of Manchester Institute of Science and Technology.

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**ABSTRACT**

The purpose of Maintenance is to extend equipment life time or at least the mean time to the next failure.

Asset Maintenance, which is part of asset management, incurs expenditure but could result in very costly consequences if not performed or performed too little. It may not even be economical to perform it too frequently.

The decision therefore, to eliminate or minimize the risk of equipment failure must not be based on trial and error as it was done in the past.

 In this thesis, an enhanced Reliability-Centered Maintenance (RCM) methodology that is based on a quantitative relationship between preventive maintenance (PM) performed at system component level and the overall system reliability was applied to identify the distribution components that are critical to system reliability.

Maintenance model relating probability of failure to maintenance activity was developed for maintainable distribution components. The Markov maintenance Model developed was then used to predict the remaining life of transformer insulation for a selected distribution system. This Model incorporates various levels of insulation deterioration and minor maintenance state. If current state of insulation ageing is assumed from diagnostic testing and inspection, the Model is capable of computing the average time before insulation failure occurs.

The results obtained from both Model simulation and the computer program of the mathematical formulation of the expected remaining life verified the mathematical analysis of the developed model in this thesis.

The conclusion from this study shows that it is beneficial to base asset management decisions on a model that is verified with processed, analysed and tested outage data such as the model developed in this thesis.