

Graduation Design Project Proposal Form

Project # P1

Project Title Design and build few kV impulse generator using semiconductor switching and triggering circuits.

Professor(s) Name(s): Prof. A. Al-Arainy & Prof Yasin Khan

Number of Students: Two

Students Qualifications

Students should have good background in High Voltage (preferable if they took EE 446)

Statement of Problem

High Voltage Labs have large impulse generators using sphere gaps for switching. However, in some applications we need impulse voltage of only few kV output using latest technology in switching and triggering schemes. This project deals with the designing, building and testing of such impulse generator. This will need designing the circuit and its implementation and testing in the lab.

Brief Description of the Project

The students are required to understand the sources of surge voltages, and methods to produce these voltages in the lab..Also they need to understand the latest switching and triggering schemes Then they will be required to design the various elements of this generator. Then they will build it in the HV lab and tested it on real applications.

Objectives

- (1) Understanding the theory behind the subject
- (2) Acquire the know how to do the complete design
- (3) Implementation of the proposed design of the impulse generator
- (4) Testing of the generator and to study its performance.

Technical Approach and Expected Deliverables

- Literature search of the project topics
- Design of the generator circuit.
- Design of the switching and control unit
- Construction of the various components of this system
- Testing the built system on real loads
- Report preparation

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Project # P2

Project Title: Design of Grounding Grid for a Power Substation

Professor(s) Name(s): Prof Yasin Khan and Prof. A. Al-Arainy

Number of Students: Two

Students Qualifications

Students should have good background in High Voltage and power systems

Statement of Problem

The ground of a substation is very important, as it provides the ground connection for the system neutral, the discharge path for surge arresters, and ensures safety to operating personnel. It also provides a low-resistance path to ground to minimize the rise in ground potential. The ground-potential rise depends on fault-current magnitude and the resistance of the grounding system.

The effects of potentials and currents on workers in substations has been carefully evaluated with regard to the electrical properties of the human body and the magnitudes of electrical current and voltage which are harmful, resulting in designs which are much safer than they otherwise would have been.

Brief Description of the Project

Low-resistance substation grounds are difficult to obtain in desert and rocky areas. In such cases, the use of grids will provide the most convenient means of obtaining a suitable ground connection. Many utilities add ground rods for further reduction of the resistance. The size of the grid and the number and length of driven rods depend on the substation size, the nature of the soil, and the ground resistance desired.

The practical design of a grid requires inspection of the layout plan of equipment and structures. The grid system usually extends over the entire substation yard and sometimes several meters beyond. To equalize all ground potentials around the station, the various ground cables or buses in the yard and in the substation building should be bonded together by heavy multiple connections and tied into the main station ground.

Objectives

- (1) Understanding the theory behind the subject
- (2) Acquire the know how to do the complete design
- (3) Implementation of the proposed design for a suitable size of substation using ETAP/Matlab modeling
- (4) Calculation of different types of step, touch and transfer voltages.

Technical Approach and Expected Deliverables

The students should understand the main components of the grounding and bonding, factors affecting the efficiency of grounding, causes and effects, measuring the output characteristics of system.

Expected dileverables is design and development of a good grounding system for power substation

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Project # P3

Project Title: Design of Energy Self-sufficient Public Building using Integrated Renewable Sources and Energy Conservation

Professor(s) Name(s): Dr. Abdulhameed Alohalay and Dr. Yasin Khan

Number of Students: Two

Students Qualifications: The students should have basic knowledge of electrical power and having good academic background in Matlab / C++ languages and related technologies.

Statement of Problem

According to the IEA, "Modern energy services are crucial to human well-being and to a country's economic development; and yet globally 1.2 billion people are without access to electricity. Even in many places with access to power, it's not cheap enough or abundant enough to lift the population above the poverty line. Access to energy is the defining limit on the ability of population to pull itself out of poverty by increasing its productive capacity.

Self-sufficient homes, also known as autonomous homes, are the ultimate in green living dwellings. These homes rely solely on themselves for heating, cooling, electricity, and more. Each self-sufficient home may be configured differently depending upon its climate, location, and the needs and desires of the homeowner.

Brief Description of the Project

In this research, an energetic, economic and environmental analysis of different configurations of a self-sufficient system for energy production from renewable sources in a public buildings is presented.

Objectives

The project have the following objectives:

- (1) Comprehensive literature review
- (2) Energy conservation in public buildings
- (3) Design a complete energy self-sufficient system

Technical Approach and Expected Deliverables

The students should understand the main components of the self energy generation and its application, factors affecting the efficiency of self energy generations, causes and effects, measuring the output characteristics of system in the laboratory, data acquisition and analysis.

Expected dileverables is design and development of an efficient self energy generation system.

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Project # P4

Project Title: Comparative Study of Breakdown Characteristics of Designed Nanofluid Insulations under AC and DC Voltages

Professor(s) Name(s): Dr. Usama Khaled

Number of Students: Two

Students Qualifications

Ability of experimental work implementation in the high voltage lab- Background about EE445 or EE446 courses if possible– High grade and qualified students.

Statement of Problem

Nanotechnology deals with characteristics in nanometer size and/or microscopic regions on materials and functional devices. In the recent past, nano-particle doped composite insulation came into use with a view to further enhance the electrical and dielectric properties.

This project will report designing of dielectric investigations into nano-fluids based on a class of metal oxides, (such as Al_2O_3 and SiO_2 , Fe_3O_4). In particular, consideration would be given to the electrical breakdown under different voltage waveforms as a function of the volumetric composition of the nano-particles in liquid insulations.

Brief Description of the Project

This project will emphasize on the breakdown phenomenon of pure transformer oils and nanofluids using the same test cell under the following conditions:

- 1- Designing and preparing an experimental set-up of discharge chamber containing high voltage electrodes and ground electrodes.
- 2- The experiments would be done under homogeneous.
- 3- Designing different samples of oils (vegetable, mineral and synthetic oils) with different concentrations of additives (mainly metallic nanoparticles)
- 4- Measure the breakdown voltage according to IEC-60156 standard
- 5- For each sample, one has to make 32 measurements (under AC, DC) and to deduce the average value.
- 6- Make a statistical analysis of experimental results (Normal probability and Weibull distribution).

Objectives

- The design will consider improvement the dielectric properties performance of high voltage liquid insulators by adding few amounts of specific nano filler into liquid insulation.
- Designing samples for increasing the breakdown voltages values of nano-fluid liquids under all voltage profiles.
- Getting an optimum volume concentration of nano particles in the used nano-fluid insulation.
- The design will help to select suitable nano particles considered for the study that gives the best performance for dielectric properties improvement of high voltage insulation liquids.

Technical Approach and Expected Deliverables

The design will be satisfied by experimental, analytical and simulation approaches.

- (a) Development of a computer program to achieve the required analysis
- (b) Use of SPSS statistical software, or a similar package, to confirm the analysis of (a)
- (c) Verify all results experimentally

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Project # P5

Project Title:

Centralized Control for Distribution Networks with Renewable Energy Resources

Professor(s) Name(s): 1. Abdulaziz Alkuhayli
2. Majed Alotaibi

Number of Students: Two

Students Qualifications

Basic Matlab programming skills.

Statement of Problem

The deployment of advanced tools such as intelligent communication infrastructures, extensive computing, and sensing technologies will improve the observability and controllability of system elements leading to smarter grid operation. Consequently, high penetration of renewable energy resources can be accommodated to meet the growing demand of electrical energy.

Brief Description of the Project

This project focuses on smart grid design and control in the distribution network. Communication-based centralized control for renewable energy resources in distribution network will be considered to improve voltage regulation and minimize losses throughout the system. The control strategy will be designed and tested using Matlab.

Objectives

- (1) Distribution system and renewable energy resources modeling.
- (2) Understanding the impact of renewables on the distribution network.
- (3) The development of centralized control in the distribution network.

Technical Approach and Expected Deliverables

- Literature search of the voltage control methods in smart grids.
- Modeling of distribution networks using Matlab.
- Design and develop a central control for in smart grid.
- Carry out a simulation using Matlab/Simulink.
- Final project report.

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Project # P6

Project Title:

Design and Control of Electric Distribution Systems

Professor(s) Name(s): 1. Majed Alotaibi
2. Abdulaziz Alkuhayli

Number of Students: Two

Students Qualifications

The students should have good background in electric power systems and distribution network engineering, in particular. Students also should have basic skills in Matlab.

Statement of Problem

With ever growing population rates and industrial market competition, power consumption and demand for the electric energy has simultaneously increased. This has placed considerable pressure on system designers to evaluate and address a suitable number of planning alternatives in detail to cope with these changes. Thus, the prime key function of distribution system design and planning is to ensure that the expected growth in power demand can be met in a timely manner by adopting certain additions to the grid in adequate, reliable, and economical ways.

Brief Description of the Project

This project aims to achieve a deep understanding of the distribution system design by analyzing and studying the main designing stages. It starts by forecasting the load for the area under study and determining the adequate number of substations required to meet the expected demand. Afterwards, the number of outgoing feeders and the optimal system configuration should be identified. Some of design criteria and corrective control actions will be utilized in order to ensure service continuity and high system quality.

Objectives

- (1) To understand the main steps of designing electric distribution systems.
- (2) To design an electric distribution network from the scratch (green-field planning).
- (3) To Analyze the obtained design and perform some corrective actions if required.

Technical Approach and Expected Deliverables

- Review the planning and design methods applied in the literature.
- Model the distribution system equipments and build overall system layout.
- Utilize several design practices to obtain the optimal capacities and locations of the assets.
- Perform load flow analysis using Matlab.
- Perform some of control actions to enhance the overall design.
- prepare a final Project Report summarizing the main findings and outlining the results obtained throughout the project.