King Saud University
College of Engineering
Electrical Engineering Department *Semester:* **411**

Senior Design Project Proposal Form

Project # E8

Project Title: Experimental estimation of temperature coefficient of bifacial photovoltaic (PV) modules.

Professor(s) Name(s): Professor Abdulrahman M. Alamoud

Number of Students: Three

Students Qualifications: EE404

Statement of Problem:
The recent manufacturing of bifacial (two sides) PV modules have given hope of power loss at higher temperatures as well as cost reduction of PV power delivered to the load. The claim is based on the fact that the saving in area and cost compared to one-sided frame type modules. They also claim that the temperature coefficient of glass-to-glass bifacial modules is superior to that of a comparable single sided PV module with metal frame.

Brief Description of the Project:
The project is intended to teach students the importance of temperature coefficient of a PV module and how to determine its value. The work will involve the disciplines of electronics, solar radiation, solar cells, and photovoltaic electric system design. A team of three students will work on the rough evaluation of temperature coefficient of bifacial PV module in comparison to standard one-sided PV modules. The team will construct a stand-alone PV system composed of one-sided and bifacial PV modules side by side to compare their temperature coefficients and area and economical savings.

Objectives:
The project objectives are as follows:
(1) To put to use theory and tools the students acquired in previous electronic courses.
(2) To acquire experience in different module technologies of a stand-alone rooftop PV system.
(3) To implement their PV system and conduct the measurements.

Technical Approach and Expected Deliverables:
The work will involve two phases covering one semester each. In the first semester the students will learn the basic principles of solar energy such as solar radiation, p-n junction solar cell design and operation, PV modules, storage batteries, and other PV system components. The students will then learn PV system design techniques. They will then construct a suitable bifacial stand-alone PV system. The students will take into account the realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, and social impact.
In the second semester, the students will work on the implementation of a small-scale stand-alone PV system consisting of bifacial and one-sided modules. Testing of the constructed PV system will commence to ensure a practical performance of the two PV module technologies. The expected deliverable is a verification of the claim of the superiority of the temperature coefficient of bifacial PV modules over one-sided ones matching the available area and budget.

Project # E9

Project Title: Comparison and cost estimation of a simple photovoltaic (PV) system design code with a comercial one.

Professor(s) Name(s): Professor Abdulrahman M. Alamoud

Number of Students: Three

Students Qualifications: EE404 and a **command of programing** (C^{++} or others).

Statement of Problem:
However, in view of the rising cost of grid electricity, it has become attractive for house owners to design and install a small grid-connected rooftop PV system to partially supply the household electric load and therefore lower the monthly electric bill. The design of the system is normally carried out using expensive and complicated commercial software.

Brief Description of the Project:
The project is intended to teach students how to design a grid-connected rooftop photovoltaic (PV) system PV system. The work will involve the disciplines of computer programing, electronics, solar radiation, solar cells, and photovoltaic electric system design. A team of three students will work to develop a software program to design a small (3-5 kW) grid-connected rooftop PV system.

Objectives:
The design objectives are as follows:
(1) To put to use theory and tools the students acquired in previous electronic and computer programing courses.
(2) To acquire experience in developing a computer code to design a grid-connected rooftop PV electric system.
(3) To verify their design code by checking it with the design given by a commercial one.

Technical Approach and Expected Deliverables:
The work will involve two phases covering one semester each. In the first semester the students will learn the basic principles of solar energy such as solar radiation, p-n junction solar cell design and operation, PV modules, storage batteries, and other PV system components. The students will then learn PV system design techniques. They will then learn the basic requirement for the design of a suitable rooftop grid-connected PV system. The students will take into account, in their PV design, the realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, social impact and ECRA regulations.
In the second semester, the students will work on the implementation of their design code of a small-scale grid-connected PV system. Testing the validity of their written code for the design of PV system will be compared to the design given by a commercial PV software. The expected deliverable is a simple design software for a small rooftop PV electric generator matching the available area and budget.

Project #E10

Project Title: ***Multiple Sensor Design for Distance and Direction Measurements***
Professor Name : Professor Majeed Alkanhal and Dr. Hamsakutty Vettikalladi
Number of Students: Two
Students Qualifications:
Statement of Problem: To invistigate, compare, and design different arrangements of simple sensors for the purpose of distance and direction measurments for security applications. Sensor arrangements and geometries will be analyzed and modeled and, hence, selected for different applications.
Brief Description of the Project: In this project, students will analyse, model, and engineer distance and direction sensors with different types and arrangements. The purpose is to invistigate and design different sensor arrangement types and shapes for different purposes of security applications.
Objectives: <u>Phase 1 (EE496):</u> Problem formulation, Sofware/Hrdware Practice, Circuit and system models, simulations and results verification. <u>Phase 2 (EE497):</u> Design and selection of different alternative sensor distribution, structures and circuits according to the proposed specifications, conclusions and documentation**.**
Technical Approach and Expected Deliverables: Technical Review acoustic sensor Basics, Specifications and alternatives, Analysis and simulation, Evaluation and adjustments to meet Specifications, Possible measurments and demonstration of simple sensor types and geometries.