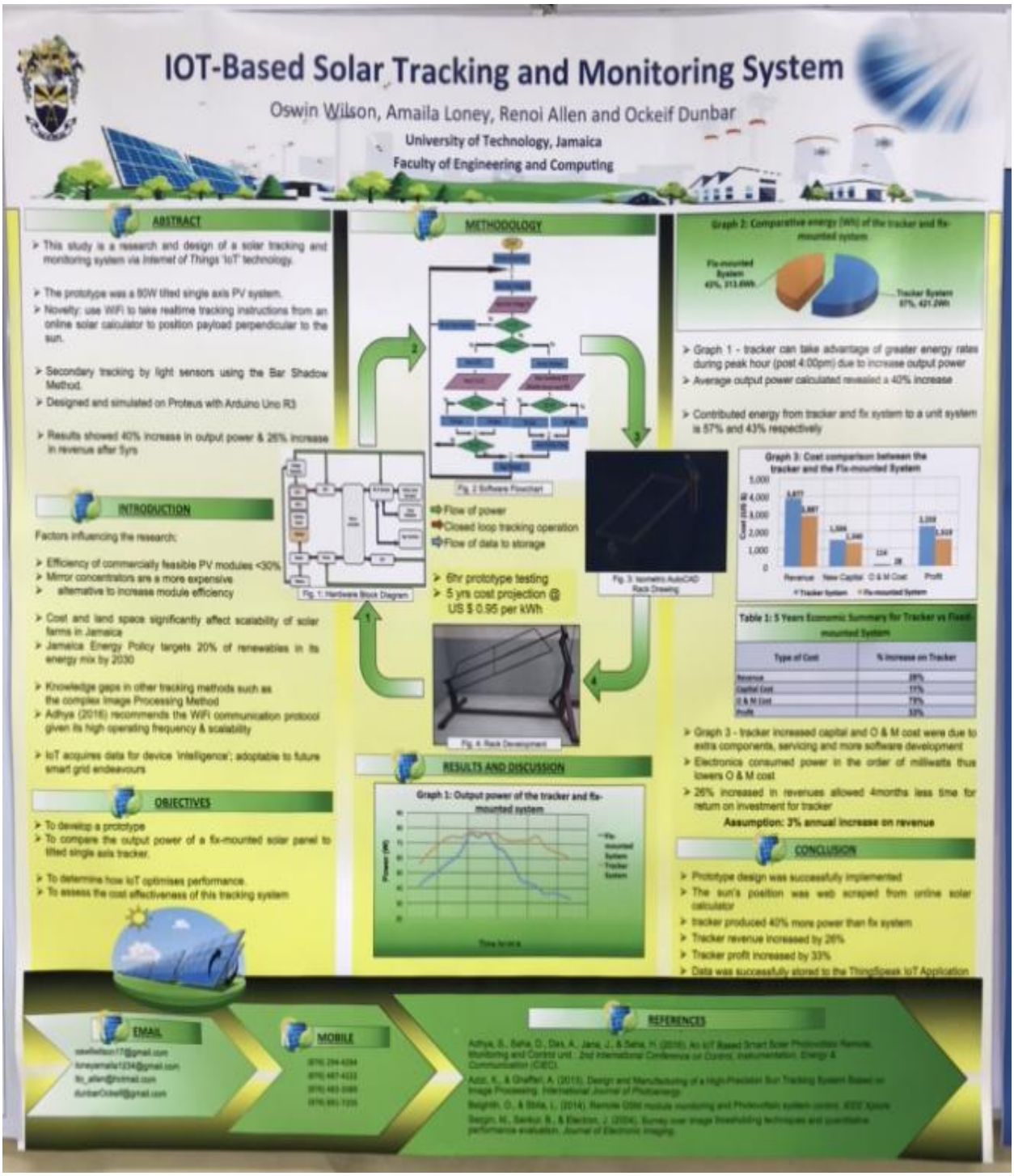
UNIVERSITY OF TECHNOLOGY, JAMAICA

Excellence Through Knowledge

SCHOOL OF ENGINEERING

ELECTRICAL BROCHURE

BACHELOR OF ENGINEERING IN ELECTRICAL & COMPUTER ENGINEERING


IOT-Based Solar Tracking and Monitoring System
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ABSTRACT
This study is a research and design of a solar tracking and monitoring system via Internet of Things 'IoT' technology.
The prototype was a 80W tilted single axis PV system.
Novelty: use WiFi to take realtime tracking instructions from an online solar calculator to position payload perpendicular to the sun.
Secondary tracking by light sensors using the Bar Shadow Method.
Designed and simulated on Proteus with Arduino Uno R3.
Results showed 40% increase in output power & 26% increase in revenue after 5yrs.
INTRODUCTION
Factors influencing the research:
Efficiency of commercially feasible PV modules <30%
Mirror concentrators are a more expensive alternative to increase module efficiency
Cost and land space significantly affect scalability of solar farms in Jamaica
Jamaica Energy Policy targets 20% of renewables in its energy mix by 2030
Knowledge gaps in other tracking methods such as the complex Image Processing Method
Adhya (2016) recommends the WiFi communication protocol given its high operating frequency & scalability
IoT acquires data for device 'intelligence'; adoptable to future smart grid endeavours
OBJECTIVES
To develop a prototype
To compare the output power of a fix-mounted solar panel to tilted single axis tracker.
To determine how IoT optimises performance.
To assess the cost effectiveness of this tracking system
METHODOLOGY
Fig. 2 Software Flowchart
Fig. 1 Hardware Block Diagram
Flow of power
Closed loop tracking operation
Flow of data to storage
6hr prototype testing
5 yrs cost projection @ US $ 0.95 per kWh
Fig. 3 Isometric AutoCAD Rack Drawing
Fig. 4 Rack Development
RESULTS AND DISCUSSION
Graph 1: Output power of the tracker and fix-mounted system
Graph 2: Comparative energy (Wh) of the tracker and fix-mounted system
Fix-mounted System 43%, 313.6Wh
Tracker System 57%, 421.2Wh
Graph 1 - tracker can take advantage of greater energy rates during peak hour (post 4:00pm) due to increase output power
Average output power calculated revealed a 40% increase
Contributed energy from tracker and fix system to a unit system is 57% and 43% respectively
Graph 3: Cost comparison between the tracker and the Fix-mounted System
Revenue
New Capital
O & M Cost
Profit
Tracker System
Fix-mounted System
Table 1: 5 Years Economic Summary for Tracker vs Fixed-mounted System
Type of Cost
% increase on Tracker
Revenue
Capital Cost
O & M Cost
Profit
Graph 3 - tracker increased capital and O & M cost were due to extra components, servicing and more software development
Electronics consumed power in the order of milliwatts thus lowers O & M cost
26% increased in revenues allowed 4months less time for return on investment for tracker
Assumption: 3% annual increase on revenue
CONCLUSION
Prototype design was successfully implemented
The sun's position was web scraped from online solar calculator
tracker produced 40% more power than fix system
Tracker revenue increased by 26%
Tracker profit increased by 33%
Data was successfully stored to the ThingSpeak IoT Application
EMAIL
MOBILE
REFERENCES

University of Technology, Jamaica

Mission Statement

"To positively impact Jamaica and the wider Caribbean through high quality learning opportunities, research and value-added solutions to government, industry and communities".

University's 2025 Vision

"We are the # 1 University in the Caribbean for work-ready leaders, committed to transforming students and society through high quality teaching, research and value-added services".

BACHELOR OF ENGINEERING IN ELECTRICAL & COMPUTER ENGINEERING

PROGRAMME DESCRIPTION

The Bachelor of Engineering in Electrical and Computer Engineering (B.Eng ECE) is a four-year course of study which aims to develop graduates with the requisite competencies and skills in analytical and creative design, to work with systems that:

1. Produce, process and propagate signals in electromagnetic forms, and
2. Generate, transmit, distribute and utilise electrical energy, as well as
3. Develop automation solutions for various industrial applications.

More importantly, the B.Eng. ECE programme seeks to provide cost-effective practice-oriented Engineering Education. This degree targets the industrial needs and opportunities within the emerging Information and Communication Technology (ICT) arena and seeks to exploit the power of the Mechatronics paradigm for Engineering Design practices.

DELIVERY & METHODOLOGY

The offering of all programmes is based on a combination of laboratories, classroom and project-based learning, as well as industry exposure. The general methodology is student-centered, outcomes-based learning, in which the students are presented at the start of each module with the learning objectives and are encouraged to do additional reading and research to supplement the instructional components.

CAREER OPPORTUNITIES

Graduates typically gain employment in the following areas: power based utility companies, communications facilities, (satellite, cable, mobile 2-way radio, military, aeronautical and marine, radio and television broadcasting, public and private telephone services), computer networking and internet services, electronic security systems services, bauxite companies, food processing plants, building services industry and other manufacturing operations.

PROGRAMME ASSESSMENT

A combination of analytical and laboratory work are designed to familiarize students with experimental equipment and procedures, and develop an understanding of the relationships of theory, experimental work and practices. All modules are assessed using a combination of the following; assignments, projects and final examinations. Students are provided with a copy of their course outline at the beginning of each module which includes the module and the schedule of content delivery, topics, assessment weightings and recommended text books.

ENTRY REQUIREMENTS

Students are admitted to the programme on the basis of CSEC achievements and approved CAPE/A-Level studies beyond the fifth form level. Students will be admitted to the Bachelor of Engineering in Electrical and Computer Engineering programme on the basis of **one** of the following:

- Five (5) CSEC/GCE O'Level including English Language, Mathematics, Physics and 2 other (Technical or Science related) subjects PLUS GCE A'Level Mathematics, Physics and one other relevant subject OR six (6) CAPE Units including Units I and II Mathematics, Physics and one other related subject in science or technology.
- Successful completion of Year One of the Diploma in Electrical or Mechanical Engineering with a minimum GPA of 3.05.
- Successful completion of UTech Diploma in Engineering with a GPA of 2.7, or equivalent field of study (for advanced placement i.e. applicant can start at second year level 2).
- Successful completion of Associate of Science Degree in Engineering from Montego Bay, Portmore or Knox Community College with a minimum GPA of 2.7; may enter the programme at the level 2. Applicants from any other approved institutions will be assessed based on individual merits. An interview may be required.

PROGRAMME OBJECTIVES

These statements describe expected accomplishments of **graduates** during the first few years after graduation. For Electrical and Computer Engineering these objectives include (but are not limited to) an ability to:

1. Apply knowledge of science, mathematics and economics to solve electrical and computer engineering problems that confront society.

2. Design and conduct experiments and analyze and interpret data collected so as to validate Electrical and Computer Engineering theories and in doing so optimise processes.

3. Function on multidisciplinary teams.

4. Communicate effectively at all levels using graphical, written and oral methods media.

5. Have an understanding of the professional and ethical responsibilities of an Engineer.

6. Critically assess the impact (environmental and otherwise) of engineering solutions in a global and societal context.

7. Use techniques, skills, computers and other contemporary engineering tools necessary for engineering practice.

8. Perform managerial functions (planning, organizing, coordinating, controlling, and supervising) during project execution, and to work efficiently with multidisciplinary teams.

9. Fulfill the academic requirements for engineering accreditation for membership in professional engineering organisations across Jamaica, the Caribbean region and also internationally.

COURSE STRUCTURE

LEVEL 1
SEMESTER 1

Module Title		Credits
COM1020	Academic Writing 1	3
MAT2018	B. Eng. Mathematics I	3
ECE1001	Fundamentals of Electrical & Computer Engineering	3
PHS1005	Engineering Physics 1	4
ECE1002	Engineering Computing	3
LIB1001	Library Fundamentals	1
➢ **TOTAL**		**17**

LEVEL 2
SEMESTER 2

Module Title		Credits
MAT2022	B. Eng. Mathematics II	3
ECE1003	Programming for Engineers	3
ENG1009	Engineering Tools	3
CHY2021	General Chemistry 1	3
CHY2022	General Chemistry Laboratory 1	1
CSP1001	Community Service Project	1
ELE2001	Electrical Networks 1	3
➢ **TOTAL**		**17**

LEVEL 2
SEMESTER 1

Module Title		Credits
ECE2001	Electrical Networks II	3
ECE2002	Electronic Devices & Circuits I	3
ECE2003	Digital Electronics	3
ECE2004	Electrical Lab Course 1	2
MAT2002	B. Eng. Mathematics III	3
COM2014	Academic Writing 2	3
➢ **TOTAL**		**17**

LEVEL 2
SEMESTER 2

Module Title		Credits
ENT3001	Entrepreneurship	3
STA2023	Engineering Statistics	3
ECE2005	Data Communication Networks	3
ECE2006	Microprocessor & Microcontroller	3
ELE3004	Signal & Systems	3
ELE2016	Electronic Devices & Circuits 2	3
➢ **TOTAL**		**18**

LEVEL 3
SEMESTER 1

Module Title	Credits
Engineering Seminar	1
Electromagnetics I	3
Engineering Economics	3
Engineering Analysis	3
Instrumentation Systems	3
Digital Systems Design	3
TOTAL	**17**

LEVEL 3
SEMESTER 2

Module Title	Credits
University Elective	3
Industrial Work Experience	3
Control Systems	3
Communication Theory	3
Electric Drives & Machines 1	3
Software Engineering	3
TOTAL	**17**

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→ COMPULSORY MODULES ←

LEVEL 4
SEMESTER 1

Module Title	Credits
Management for Engineers	3
Major Project 1: Research Methods	3
Electrical Power Systems	3
➢ **TOTAL**	**9**

ENGINEERING ELECTIVES
(CHOOSE ANY 2)

Module Title	Credits
Transmission Lines & Antennas	4
Microwave Communications	4
Computer Networks	4
Operating Systems for Engineers	4
Telephony Systems & Networks	4
Electric Drives & Machines 2	4
Alternative & Renewable Energy & Power Systems	4
Industrial Electronics	4
Computer-Based Control Systems	4
Network Security	4
Power Electronics	4
VLSI Design	4
Maintenance Engineering & Management	3

→ COMPULSORY MODULES ←

LEVEL 4
SEMESTER 2

Module Title	Credits
Electrical Facilities and Safety	3
Major Project: Design & Build	3
Digital Signal Processing	3
➢ **TOTAL**	**9**

ENGINEERING ELECTIVES
(CHOOSE ANY 2)

Module Title	Credits
Digital Communication	4
Computer-Based Control Systems	4
Real-Time Systems	4
Mechatronic Systems	4
Modern Control Systems	4
Power System Protection	4
Computer Networks	4
Alternative & Renewable Energy & Power Systems	4
Telephony Systems & Networks	4
Project Management	3

COURSES AND COURSE DESCRIPTION

[COM1020] Academic Writing 1

This module is designed at enabling an increase in students' capacity to efficiently utilize receptive and expressive language skills in order to function effectively within the tertiary level environment. It focuses on the inter-related language skills: reading, listening and writing. The module is divided into three units: **Acquiring and Processing Information, Basics of Message Production** and **Message Production in Academic Contexts.** Although each unit has its own focus, all three are inter-related and each is meant to reinforce the other.

[MAT2018] B.Eng Mathematics 1

In this module students will be introduced to intermediate aspects of calculus. These include advanced optimization applications of differentiation using LaGrange multipliers, McLaurin's theorem, and evaluation of double integrals. This module helps the students to understand the concepts and demonstrates applications in the theory of linear algebra.

[ECE1001] Fundamentals of Electrical & Computer Engineering

This module introduces the basic principles and components of electrical and computer engineering. Topics include basic electrical parameters, components, and the theory and analysis techniques used to analyze and design electric and electronic circuits. Students will use the knowledge gained in the application of relevant engineering software in circuit design and analysis before actual physical circuit connection.

[ECE1002] Engineering Computing

This module introduces students to the use of computer software in the field of engineering through the primary use of MATLAB, MS Excel or similar software packages. Students will benefit from the increased the efficiency in performing computations, simulation, information processing and graphical visualization. This module should improve the students' confidence in writing small engineering programs for problem solving.

[PHS1005] Engineering Physics 1

This syllabus is designed to build on the physics base established in the PCS programme. The topics are treated at an advanced level with emphasis on the understanding and application of physical concepts and principles.

[LIB1001] Library Fundamentals

The module is designed to develop in students the capacity to efficiently use the library and to equip them with the skills to deal with the Information Age. It will assist them in coping efficiently and effectively with the continuous growth of information and the technologies to harness the relevant information sources in whatever format (print, electronic, also whether it is found in books, journals or in multi-media) that it exits.

[CHY2021] General Chemistry 1

This module is designed to introduce the student to some of the fundamental concepts required in the study of Chemistry, and is a blend of physical and inorganic chemistry. It includes ten (10) units; starting with the Foundations of chemistry, then taking a close look at the structure of the atom, periodic trends, rates and energy changes of chemical reactions and electrochemistry. The module provides a springboard for other more advanced chemistry modules.

[CHY2022] General Chemistry Laboratory 1

This module is designed to develop and enhance the laboratory skills of students doing General Chemistry I. It also serves to complement and reinforce the theoretical aspects of the General Chemistry I module. The module introduces students to basic laboratory techniques that will stand in good stead for more advanced chemistry modules and therefore students will be expected to master the techniques taught in this module before taking on more advanced chemistry modules.

[ECE1003] Programming for Engineering

The aim of the module is to expose the student to the major elements of Programming language while utilizing Object Oriented Programming, C++ and MatLab techniques to model common Electrical Engineering situations and develop their implementations or solutions.

[ENG1009] Engineering Tools

The module exposes the student to engineering fundamentals and applications. It is intended to give entering students a view of what engineers do professionally. The module is designed with a theoretical and practical component. The theory includes: background and history of engineering, engineering team, engineering ethics, engineering analysis and design, technical communication and engineering calculations. The practical component includes electrical and mechanical workshop and engineering graphics and is geared towards preparing students for safe and effective engineering practices. The final practical component will introduce computer drafting packages such as AUTOCAD to demonstrate to the students how drafting software can be utilised in engineering design. The student will be exposed to various standards for engineering drawings.

[MAT2022] B.Eng Mathematics 2

Many engineering systems may be modeled by either ordinary or partial differential equations. The engineering students must therefore obtain competence in solving and interpreting the results of these equations. The aim of this course is to introduce the students to the various standard techniques used for solving differential equations. Various engineering problems will be used as illustrated examples.

[CSP1001] Community Service Project (CSP)

This module covers the importance of volunteerism in contributing to an improvement in the quality of life in communities around UTech and Community Colleges which deliver its programmes as well as, the wider society. It further unites classroom instructions with real societal needs and explores the relationship between General Education modules and CSP 1001.

[ELE2001] Electrical Networks 1

This course seeks to improve the capability of students in the analysis of electrical circuits using fundamental circuit theorems. The course initially focuses on analyzing resistive networks but proceeds to include other passive elements. Frequency analysis of systems and signals is also addressed.

[ECE2001] Electrical Networks 2

The module reviews network theorems developed in Electrical Networks 1, using them to analyse more complex circuits. The effects of interconnection between networks are also assessed. Further transient circuit and complex frequency analyses are done. In addition to these, students will be introduced to the significance of poles and zeros, filters circuits (passive and active).

[ECE2002] Electronic Devices & Circuits 1

This module provides theoretical as well as practical insights into fundamental concepts of design and analysis of modern electronics circuits. Emphasis at this level are placed on the characterization of diodes, (BJT) transistors, field effect transistor (FET) and effect of temperature variation. Circuits are analyzes using both large and small signal analysis.

[ECE2003] Digital Electronics

This module provides step-by-step procedures for the design and analysis of digital circuits; beginning with the foundation of Boolean expression and analysis Boolean algebra. The student will be introduced to logic circuit design such as timing circuits, memory circuits, flip-flops, multiplexers and shift registers.

[COM2014] Academic Writing 2

The ***Academic Writing II*** module covers skills in critical thinking and reading, information gathering, documentation and argumentation. It focuses on developing reasoning and problem solving competencies and demands the effective use of both receptive and expressive skills. The module is divided into four units: **The Concept of Critical Thinking, The Critical Thinking Process, Critically Evaluating Arguments** and **Writing the Argumentative Research Essay. A**ll three units are inter-related and the skills and competencies acquired in each are reinforced in the others.

[MAT3004] B.Eng Mathematics 3

In this module students will be introduced to Laplace transform and Fourier Analysis. It helps the students to develop mathematical skills to analyze signals and systems using transform techniques.

[ECE2004] Electrical Lab Course 1

This course introduces students to both electronic, electrical components and digital circuits. Basic analog and digital circuits' theory of operation are covered. The labs allow the students to master the use of electronic instruments and construct and/or solder several circuits. The labs reinforce concepts discussed in class with a hands-on approach.

[ECE2005] Data Communication Networks

This module introduces the student to the concepts and terminology of data communications and networking. It includes topics on communication models, network protocols, standards, LANs, WANS, the Internet, intranet and networking applications. The emphasis will be to develop an understanding of the underlying principles of data communications and networking.

[ECE2006] Microprocessors & Microcontrollers

The module is an introduction to microprocessor system hardware architectures and assembly language programming covering the range from 8-bit microcontrollers through to modern PC processors and concepts of parallel processing.

[STA2023] Engineering Statistics

In this course students will be introduced to basic probability and statistics. Emphasis will be placed on areas that are important to experimental design and quality improvement. The practical applications to engineering will be highlighted.

[ELE3004] Signals and Systems

This course provides theoretical concepts and also the mathematical representation of signals and systems. Continuous time and discrete signals characteristic and behavior will be examined in details. Continuous time and discrete systems will be examines and their related response to these signals. Related Transform for signal and system will also be studied.

[ELE2016] Electronic Devices & Circuits 2

This course is a continuation of Electronic Devices and Circuits 1 which provides further theoretical and practical insights into fundamental concepts of design and analysis of modern electronics circuits to include: Difference amplifiers, low and high frequency analysis, Op-amp, linear and non-linear inverting amplifier, and feedback. Practical in: Op-amp circuit, Comparators, feedback amplifiers and oscillators.

[ENT3001] Entrepreneurship

This module guides participants through the process of entrepreneurship and business creation and culminates with the development of a business plan. It covers topics ranging from creativity, idea generation, business model development, intrapreneurship and marketing, through to the legal and financial aspects of business. The module seeks to enable participants to appreciate the role of creativity, innovation and entrepreneurship in adding value to economic pursuits. The aim is to increase the number of persons who see entrepreneurship and business creation as viable alternatives for employment and contribution to society.

[ENG1006] Engineering Seminar

Significant importance has been given to seminars. Besides subject specialists, who will be invited to discuss topics of interest, every student will be required to write a report on an engineering topic and hold a seminar on it. This is aimed at increasing the communication skills of the student.

[ECE3001] Engineering Analysis

This is an analytic modelling for engineering processes and systems in fluid mechanics, heat transfer, rigid body dynamics, and machine design module. Practical interpretations of analytic and approximate solutions for steady and non-steady state problems are covered. Coverage also includes: introduction to linear algebra, statistics and their applications in engineering analyses. This is an engineering module – not another math module.

[ECE3002] Instrumentation Systems

This module introduces students to the fundamental principles of measurement and the design of electronic measurement systems. Students will be exposed to error analysis, the elements of a measurements systems, the working principle of commonly used sensors, signal conditioning circuits design and data acquisition systems.

[ECE3003] Digital Systems Design

This module expose students to the theoretical basis and practical skills in modern design of small to medium size digital systems in various technologies, with a focus on Field Programmable Gate Arrays (FPGAs). The module introduces digital systems design with hardware description languages (HDL), programmable implementation technologies, electronic design automation design flows, design considerations and constraints, design for test, system on a chip designs, IP cores, reconfigurable computing, digital system design examples and applications.

[ELE3001] Electromagnetics 1

Electromagnetics I is an introductory course in electromagnetic theory, including vector algebra, transformations and calculus, electrostatic and magneto static fields, electric fields, properties of dielectric materials, and plane waves. It provides the necessary grounding for the more application orientated Electromagnetics II.

[ENG3011] Engineering Economics

This course introduces engineering students to the main concepts in economics studies and their relation with various aspects of engineering design and manufacturing operations at various contexts. Topics relating optimization are also introduced in this course.

***** University Elective *****

All Engineering Degree Students have to choose a University elective.

[ENG4010] Industrial Work Experience

The industrial work experience will allow undergraduate engineering students to interact directly with practicing engineers in their specific technical environments. Emphasis will be placed on problem solving techniques and procedures as well as the understanding ethical and professional standards. Students will be exposed to trouble shooting and problem solving at the industrial level.

[ECE3004] Control Systems

Control systems represent one of the areas in which computers are heavily involved in the analysis, design and control of systems. Students will be exposed to mathematical foundation, transfer function, block diagram and signal flow graph. State – variable analysis of linear dynamic systems, time-domain analysis of control systems, root locus techniques, and frequent-domain analysis of control systems.

[ECE3005] Communication Theory

This course provide the mathematical analysis, theoretical and practical basis for all other course which involve electronic communication at the degree level. Topics include: Review of Fourier series and Fourier transform, spectral densities of deterministic signals. Base-band and Band-pass linear systems, AM FM modulation/demodulation schemes, Elements of PCM, Noise in communication systems.

[ECE3006] Electrical Drives & Machines 1

This is a continuation of Electric Drives & Machines 1. The construction and operating principles of alternating current generators, synchronous motors, induction machines, and polyphase transformers will be examined. The Electric drives system, motor selection and applications, starting methods, electric braking, and the need for cooling of electrical machines will also be studied.

[CMP3026] Software Engineering

Software Engineering is a core discipline of Computer Science. This course is the first of three (3) courses in Software Engineering. It exposes students to basic concepts and methods of software development using the team philosophy. The course provides an overview of the software development process followed by a detail study of the Requirement Analysis and Specification Process.

[ENG4016] Management for Engineers

The objective is to deliver a course of lectures to the students on selected important aspects and areas of Management and Planning. The course must expose them to the existing body of knowledge in the areas of management, organizational theory, marketing, production management, and project planning.

[PRJ4029] Major Project 1: Research Methods

This module introduces the currently accepted quantitative and qualitative methodologies necessary to enhance the skills and knowledge needed to plan and carry out research for Major and Senior Engineering Projects. It further, equips the participants with the tools necessary to critically assess research methods used for Engineering and Scientific inquiry and to facilitate the development of practical skills necessary for critically analyzing different research styles. This module combines lectures and tutorials in a manner that emphasizes practical application. There is no final examination.

[ECE4001] Electrical Power System

The module looks at the structure, operation and protection of electrical power systems. Consideration is given to the generation options of electrical energy, including renewable, the equipment used in the transmission and distribution of this energy and the key considerations required for effective and efficient interconnection.

- **Engineering Electives (Choose any two)**

[ELE4001] Electric Drives & Machines 2

This is a continuation of Electric Machines & Drives I. Industrial motion: torque, speed position control. Electrical traction, braking and heating will be studied. Alternating current generator, synchronous motors and single-phase motors will also be examined.

Industrial motion: torque, speed, position-control is paramount in raising productivity and in reducing energy equipment costs in all industries. Electric drives share most of industrial motion control applications and would be a major area of study in this course. Electrical traction, braking and heating will also be studied. This is basically a continuation of the study of construction and operation of all machines not covered in Year 3. In addition, the application of all machines will be studied.

[EEE4003] Transmission Lines & Antennas

The course covers transmission lines, closed microwave-guides and micro-strip, SWR transmission line impedance. Also covered in this course are: Input impedance of antennas and antenna current, Dipole antennas and vertical wires, Quarter-wavelength and half-wavelength antennas, Parabolic reflectors, slot and horn, Radiation, power density and radiated power from antennas.

[EEE4002] Microwave Communications

This course emphasizes an analytical approach in the understanding of the fundamental concepts of microwave communication. Topics include: the examination of microwave devices, the impact of noise in communication, satellite systems, cable transmission systems, VSWR, impedance matching and microwave antennas. In addition to the foregoing, an overview of system performance and system specification requirements are given.

[ENG4001] Alternate & Renewable Energy & Power Systems

This module introduces the students to conventional and non-conventional energy sources, conversion technologies used to produce electrical energy, energy storage methods and energy management. The knowledge gained should assist the students in assessing energy conversion processes and energy use with a view of making informed choices and recommendations.

[ENG4005] Computer Networks

This module provides the student with an understanding of designing computer networks, network operating systems, network standards, internetworking devices and network protocols and analysis of resources required for optimizing a computer network.

[EEC3001] Operating Systems for Engineers

This module is designed to introduce students to the concepts of an essential part of a computer system the operating system. It demonstrates what operating systems are, what they do, how they do it, how their performance can be evaluated and how they can be compared with each other.

[ENG4007] Telephony Systems and Networks

The course is designed to give the student a comprehensive technical overview of the telephony systems and network technology in use today. The knowledge base thus obtained provides technical managers with the tools necessary to make informed decisions for the operation and management of telephone switching systems and transmission networks, and to appreciate the marketing, operator services and other support roles in the industry.

[EEI4001] Industrial Electronics

The course will cover a range of design and applications of digital and analog electronics circuits used in the areas of controls, instrumentation and power system engineering. Some of the specifics areas to be looked at include: the generic architecture of Programmable Logic Controllers and there use in discrete control systems application, the application of thyristors to variable speed drive circuits for both AC and Dc motor, application of digital pulse and timing circuits to communications and controls circuit design, proximity sensors, optical encoders, contactors and so forth.. The circuit and application designs to be covered will take advantage of existing and commercially available components and ICs.

[ENG4009] Computer Based Control Systems

The introduction of computers in manufacturing workplace in the form of IT in general and automation in particular has revolutionized the way in which the industry operates. This course will concentrate on the use of computers in wide areas of control applications. These will range from large factory networks linked across the world to Microcomputers communicating with each other on board a complete system such as an aeroplane. This course provides the foundation that in the future the student will be able to enhance his/her learning through further applications and study.

[EEC4002] Network Security

This course serves as an introduction to various aspects of network security at the degree level. Topics covered include encryption and decryption, hash functions, key-exchange algorithm and aspects of Web security. The student is also introduced to legal and ethical aspects regarding cybercrime, computer crime and intellectual property.

[ENG4015] Power Electronics

The course introduces the learner to the conversion of electrical energy and power conversion. Topics include: DC to DC Switch mode converters, an overview of semi-conductor switches The module introduces the student to Characteristics of power electronics devices (such as diode, BJTs, MOSFETs, SCR).

[ENG4020] Maintenance Engineering & Management

The student will learn the theoretical, statistical, practical, and the logical, treatments of industrial maintenance. In addition, the student will be exposed to organizational management and quantitative techniques used in maintenance.

[PRJ4030] Major Project 2: Design and Build

This module offers the students an opportunity to design and build solutions for realistic engineering problems that in turn provides learning opportunities that are student- centered.

[ECE4002] Electrical Facilities and Safety

This module presents overview of the electrical and mechanical systems of buildings. Content includes systems, and energy management; review of mechanical systems, such as HVAC, refrigeration, plumbing, and fire protection; electrical and mechanical building codes; indoor air quality, communications, life safety and security systems.

[ECE4003] Digital Signal Processing

Students are introduced to the basic digital signal processing operations including sampling and reconstruction of continuous time signals, and time-domain operations. Fourier and Z-transforms are used to analyze the stability and frequency response of discrete time systems and to find the system transfer function. Other topics include Discrete and Fast Fourier Transforms (DFT) and (FFT) and techniques for designing and analyzing Finite and Infinite Impulse responses (FIR) and (IIR) filters.

- **Engineering Electives (Choose any two)**

[EEP4002] Power Systems Protection

This course seeks to provide students with an understanding of the hardware used in the protection of power system equipment. The principles governing unit and non-unit protection schemes are also explored. Determination of the relative merits of protection involving solid state and electromechanical hardware is also explored.

[MEE3010] Project Management

This course focuses on the planning, scheduling, organizing, and controlling of projects. Projects may involve product development, facility construction, system installation, new business ventures, production layout, or organizing special events. The course integrates the major topics of strategy formulation, organizational structure, project management tools and leadership. As project management becomes increasingly more important in today's world, mastery of its' key tool and concepts is essential in maintaining a competitive advantage in the market place.

[EEE4004] Digital Communications

This module covers the concepts of entropy, data compression and error correction are also covered. Models of digital communication systems, concept of mutual information and channel capacity, Pulse Code Modulation, simple digital modulation techniques, Amplitude Shift Keying, Frequency Shift Keying and Phase shift keying, coherent detection of binary signals in noise and matched filters are also covered.

[ENG4009] Computer Based Control Systems

The introduction of computers in manufacturing workplace in the form of IT in general and automation in particular has revolutionized the way in which the industry operates. This course will concentrate on the use of computers in wide areas of control applications. These will range from large factory networks linked across the world to Microcomputers communicating with each other onboard a complete system such as an aero plane. This course provides the foundation that in the future the student will be able to enhance his/her learning through further applications and study.

[EEC4005] Real-Time Systems

In this module students will study real-time software technology underlying many embedded systems such as automobiles, smart phones, multimedia devices and avionics. Topics covered will include real-time scheduling theory, real-time operating systems and middleware, Quality of Service and real-time wireless sensor networks. Students will critique papers and performs a system project on embedded platforms.

[EEI4002] Mechatronic Systems

This course provides the student with an introduction to the fundamentals of mechatronics and the engineering concepts and techniques that underpin the subject: planning, search techniques, sensors, actuators, control systems and architectures. Students will be exposed to selection criteria, manufacture and trends in the area of mechatronics.

[EEI4003] Modern Control Systems

The module looks at linear discrete dynamic system analysis using Z-transform, properties of Z-transform, discrete equivalent to continuous transfer functions and the digital filter. It also looks at analysis of sampling, data extrapolations; block diagrams reduction techniques, stability analysis of digital control systems using frequency response (W- Transform) and root locus methods. Students will be exposed to the design of digital control system using state-space methods.

[ENG4015] Power Electronics

The module introduces the students to the conversion of electrical energy and power conversion. Topics include: DC to DC Switch mode converters, an overview of semi-conductor switches. The module introduces the student to Characteristics of power electronics devices (such as diode, BJTs, MOSFETs, SCR).

[ENG4005] Computer Networks

This module provides the student with an understanding of designing computer networks, network operating systems, network standards, internetworking devices and network protocols and analysis of resources required for optimizing a computer network.

[ENG4001] Alternate & Renewable Energy & Power Systems

This module introduces the students to conventional and non-conventional energy sources, conversion technologies used to produce electrical energy, energy storage methods and energy management. The knowledge gained should assist the students in assessing energy conversion processes and energy use with a view of making informed choices and recommendations.

[ENG4007] Telephony Systems and Networks

The module is designed to give the student a comprehensive technical overview of the telephony systems and network technology. It covers cellular network systems, telephone traffic management, signaling systems and Telephone network architecture.

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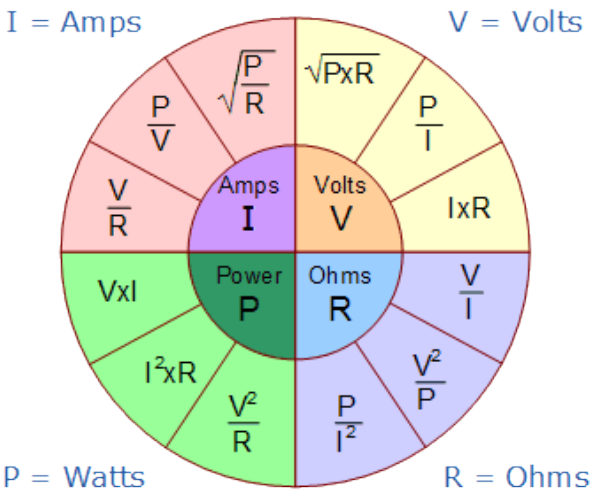
DC Ohm's Law

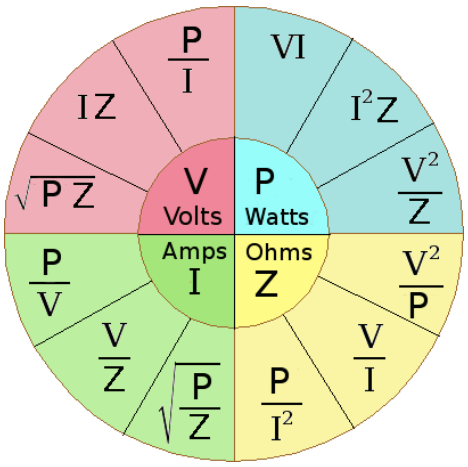


Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points. Introducing the constant of proportionality, the resistance, one arrives at the usual mathematical equation that describes this relationship;

$$I = \frac{V}{ZR}$$

where *I* is the current through the conductor in units of amperes, *V* is the voltage measured *across* the conductor in units of volts, and *R* is the resistance of the conductor in units of ohms. More specifically, Ohm's law states that the *R* in this relation is constant, independent of the current. Ohm's law is an empirical relation which accurately describes the conductivity of the vast majority of electrically conductive materials over many orders of magnitude of current.

AC Ohm's Law



The familiar Ohm's Law triangle used for DC circuits can only be used at AC if the load is purely resistive. Most AC circuits however, contain series or parallel combinations of resistance, capacitance and inductance. This leads to the voltage and currents being out of phase and the load becomes complex. In purely capacitive circuits the current waveform leads the voltage waveform, whereas in inductive circuits the voltage will lead the current. Circuits containing both inductors and capacitors, the voltage and current waveform will not be in phase except at resonance. The general term for AC resistance is impedance and given the symbol Z. The mathematical equation that describes this relationship is shown below:

$$I = \frac{V}{Z}$$

Source:
www.zen22142.zen.co.uk/Theory/ohmac.htm

The heights by great men reached and kept were not attained by sudden flight, but they, while their companions slept, were toiling upward in the night.

By: Henry Wadsworth Longfellow