Electronics Engineering

UNDERGRADUATE INFORMATION GUIDE

Regulations, Syllabus
&
Time Tables

General Information

The programme

The Bachelor of Science in Electronics Engineering is a 3 year programme that is offered through the Department of Physics and the Electronics Unit within the Faculty of Pure and Applied Sciences, Mona campus. The academic quality and standard of this programme is overseen by The U.W.I. Faculty of Engineering in St. Augustine, Trinidad. This programme is being introduced as part of a decision to expand The UWI's engineering programmes to other UWI Campuses starting with the Mona Campus in Jamaica. Students must complete the list of approve courses totaling 103 credits.

The Bachelor of Science degree in Electronics Engineering is designed to serve students who are desirous of pursuing a career path in Telecommunications and Industrial Instrumentation. This three (3) year programme is structured in such a way that during the first year, students are exposed to foundation courses in electronics and electrical engineering, physics, computer science, engineering mathematics, ethics and professional practices. The second year courses provide the core courses for this engineering discipline. All students are required to complete a 1-year extensive project during the final year along with the introduction to engineering management and accounting systems course, venture capital and entrepreneurship, and electromagnetism. Students must select only one option - Telecommunications or Industrial Instrumentation.

During each semester of this 3-year program, a teaching laboratory and project design course must be taken by each student. The practical application and testing of the concepts presented in the theoretical classes for that semester will be explored in these lab sessions. Engineering students learn through a combination of design and lab work. This mix of theory and practical application allows students to think things through and then apply their ideas in a variety of real life situations. Students also learn to diagnose problems and develop a variety of solutions.

Years of Study: 3 years

Minimum number of credits for graduation: 102 credits (including 9 credits from 3 FD courses)

Admission Requirements

In addition to fulfilling general requirements for admission into the Faculty of Pure and Applied Sciences, applicants must have passes in both units of Mathematics and Physics at CAPE or Advanced level, normally with grade 3 (or C) or higher; or passes in PHYS0410, PHYS0420, MATH0100 and MATH0110, normally with no less than a B; or equivalent qualification from a community college, CASE, UTECH or another university with GPA of 2.5 or higher. Applicants with a Diploma in Electrical or Electronics engineering may matriculate into Level 2 if their Diploma GPW is at least 3.

The above requirement may be subjected to annual revisions.

GPA Requirements

GPA requirements are consistent with that of the Faculty of Pure and Applied Sciences. Upon completion of the required courses for the degree, candidates must possess a GPA of 1 or greater in order to satisfy the graduation requirements. The GPA (or quality points) for this engineering option is calculated from ALL COURSES from Level 1 to Level III that constitute the candidate's degree. The actual GPA will determine the class of degree received. More detail guidelines are available in the Faculty Yellow Handbook. The GPA – Grade assignment for Mona Campus is shown in Table 1 and the type of Degree in Table 2:

Table 1:

Grade (range)	GPA	Grade (range)	GPA	Grade (range)	GPA	Grade (range)	GPA
A+ (86-100)	4.3	B+ (63 - 66)	3.3	C+ (53 – 56)	2.3	D+ (43 – 46)	1.3
A (70 - 85)	4.0	B (60 – 62)	3.0	C (50 – 52)	2.0	D (40 – 42)	1.0
A- (67 – 69)	3.7	B- (57 – 59)	2.7	C- (47 – 49)	1.7	F (0 – 39)	0.0

Table 2:

Degree Class	Cumulative GPA	Degree Class	Cumulative GPA	Degree Class	Cumulative GPA	Degree Class	Cumulative GPA
First	3.6 and above	Upper 2nd	3.00 – 3.59	Lower 2nd	2.00 – 2.99	Pass	1.00 – 1.99

Academic Quality Assurance

Quality assurance systems are aligned with that of the Faculty of Engineering at St Augustine where they are well defined and linked to programme outcomes and individual courses learning outcomes. The Faculty of Engineering, St Augustine, will oversee the adherence to the guidelines set by the accrediting agencies.

The Mona Campus of The University of the West Indies intends to apply for accreditation in

2012/2013 after the first cohort of electronics engineering students has graduated.

Syllabus and Course Outline

Definition Course Codes:

ECNG	Electrical and Computer Engineering (St Augustine Campus)
ELNG	Electronics Engineering (Mona)
ENGR	Faculty of Engineering (St. Augustine)
ELET	Electronics (Mona)
COMP	Computer Science (Mona)
MATH	Mathematics
PHYS	Physics (Mona)
MGMG	(Management Studies (Mona)

Note:The letter 'E' or 'C' preceding the credit allocation indicates Examination by written papers or by Course Work, respectively.

COURSE OUTLINE

LEVEL 1

Semester 1 (15 Credits)

Course Code	Title	Number of credits
ECNG 1000	Electrical Circuits	E 3
ECNG 1009	Introduction to Programming	C 3
ENGR 1000	Introduction to Engineering	E 3
ELNG 1101	Physics for Engineers	E 3
MATH 1180	Engineering Mathematics 1	E 3

Semester 2 (16 Credits)

Course Code	Title	Number of credits
ELET 1400	Introduction to Electronics	E3
ELET 1405	Practices in basic Electronics	C/E 3
ECNG 1012	Engineering Science and Technology	C 4
COMP 1160	Object Oriented Programming	E3
FOUN 1001	English for academic Purposes	E 3

Note: The other Foundation Courses may be taken at any time during the undergraduate course of study. See Faculty Handbook for more information

LEVEL 2

Semester 1 (15 Credits)

Course Code	Title	Number of credits
ELET 2405	Practices in Electronics 1	C3
ELET 2430	Digital Circuits and Microprocessors	E3
ELET 2450	Embedded Systems	E3
ELET 2460	Signals and Systems	E3
MATH 2230	Engineering Mathematics 2	E3

Semester 2 (15 Credits)

Course Code	Title	Number of credits
ELET 2415	Practices in Electronics 2	C3
ELET 2410	Analysis and Design of Analogue Circuits	E3
ELET 2420	Semiconductor Devices	E3
ELET 2480	Modern Communications	E3
ECNG 2009	Control Systems	E3

Summer Apprenticeship Internship in Approved Industry (between Level 2 and Level 3)

Summer Apprenticeship is meant to expose students to the practical applications of the concepts learnt in classes and is expected to be a source of motivation and inspiration. It also provides an opportunity to identify potential projects.

LEVEL 3 (35 credits)

Students taking Level 3 courses must:

1. Register for all courses listed as compulsory and core (for chosen option).
2. Select one of the following options:
   Telecommunications or Industrial Instrumentation
3. Get your assigned year long project (ECNG3020) from the project coordinator.

COMPULSORY COURSES

YEAR-LONG (6 Credits)

Course Code	Title	Number of credits
ECNG 3020	Special Project	C6

One Semester (14 Credits)

Course Code	Title	Number of credits
ECNG 3021	Introduction to Engineering Management and Accounting Systems	E4
MGMG 3136	New Venture Creation and Entrepreneurship	E3
PHYS3385	Electromagnetism	E4
ELET3405	Practical Analysis of Advanced Electronics Circuits and Systems	C3

Core Courses (12 credits)

Option 1: Telecommunications

Course Code	Title	Number of credits
ELET 3480	Wireless Communication Systems	E 3
ELET 3470	Wireless Transmission & Fiber-Optics	E 3
ELET 3460	Digital Signal Processing	E 3
ELET 3460	Digital Signal and Image Processing	E 3
ELNG 3050	Broadband Networks	E 3

Option 2: Industrial Instrumentation

Course Code	Title	Number of credits
ELET 3412	Instrumentation and Measurements	E 3
ELNG 3030	Power Electronics and Protection Circuits	E 3
ELNG 3040	Industrial Automation	E 3
ELNG 3060	Power Plant Instrumentation	E 3

Electives (3 credits)

Choose any other level 3 Electronics course

Some Rules and Regulations:

i. In addition to other requirements, all three (3) Foundation courses must be passed before the student is allowed to graduate
ii. A minimum of 102 credits (including 9 credits from the three foundation courses) is required to graduate from the Electronics Engineering BSc. Programme
iii. The maximum course loading normally allowed per semester is 18 credits
iv. Registration for Level 3 courses will not be approved until credits for all level 1 courses and have been attained. Additionally, all required prerequisite level 2 courses must be completed (passed).

COURSE DESCRIPTIONS

Level I Courses:

ECNG1000 **ELECTRICAL CIRCUITS**
(3 credits) Semester 1 Level I

Syllabus: Introduction to signals and systems, modeling of electrical systems and devices, network theorems, nodal and loop analysis, circuits with reactances. Transient response, AC steady state, phasor analysis of single phase systems. Lab exercises will be assigned in the ECNG1012 electrical laboratory sessions.

Evaluation:
One 3hr final exam 90%
One in-course exam 10%

ENGR 1000 **INTRODUCTION TO ENGINEERING**
(3 credits) Semester 1 Level I

Syllabus: An introduction to the following: historical development of engineering; formation of the engineer; roles and functions of engineers and professional organizations; creative and critical thinking; technical communication; Ethics; liability; safety; legal forms of association; contracts, company law; intellectual property; engineering economics and business operations; infrastructure; energy systems and economics, environment and sustainable development; approaches to design.Field trips to local industries.

ECNG 1009 **INTRODUCTION TO PROGRAMMING**
(3 credits) Semester 1 Level I

Syllabus: Standard algorithms and general problem-solving using algorithms. Number representations and binary number manipulation. Algorithm coding on a language independent platform and in C++

Evaluation:

Six (6) lab base course work	24%
Two (2) in-course assessment	46%
Ten (10) tutorials/assignment	30%

ECNG 1012 **ENGINEERING SCIENCE AND TECHNOLOGY**
(4 credits) Semester 2 Level I

Syllabus: Engineering Science and Technology is a partial-laboratory course and is assessed solely through coursework. This course has five modules:

- Electrical Labs and Design Project:
  Four lab exercises (with simulations) and a design project based around the ECNG1000 course.

- Science of Materials:
  Metals, polymers, ceramics and composites, semiconductor and superconductors, piezielectrics

- Engineering Graphics:
  Use of instruments, orthographic projections, pictorial views, and freehand sketching.

- Mechanical Workshop Technology:
  Safety orientation, screw driver design project – cutting of material, hot forging, marking off and filing, construction of handle and collar, assembly, pinning and fastening of collar, handle and stainless steel blade, testing; Arc welding training – construction of a T-joint.

- Mechanics of Fluids:
  Properties of fluids, hydrostatics, fluid dynamics – types of fluid flow, continuity equation, Bernoulli's equations and its applications, momentum equation; Laminar and turbulent flow; rotational machines – pump characteristics, centrifugal pumps under system load, pumps in series and in parallel; one laboratory exercise.

Evaluation:

Four (4) Electrical Lab exercises with reports	20%

One Electrical Circuit design (Practical Exam & report)	20%
Six in-class Engineering Graphics exercises	10%
One mechanics of Fluids in-course exam	15%
One mechanics of Fluids Lab Exercise & Report	5%
One Science of Materials In-Class Exam	10%
Mechanical Workshop Technology	20%

MATH 1180 **ENGINEERING MATHEMATICS 1**

(3 credits) Semester 1 Level I

Syllabus: Functions of one variable: Limits, continuity, differentiation and integration; common functions and inverse functions. Mean value theorems; Taylor and Maclaurin expansions.

Function of two variables: Limits, continuity and differentiations.

Vectors: Dot, cross and mix products; geometrical problems - lines, planes.

Matrices: Definitions, properties, solution of linear equations. Complex Number: Polar representation.

Ordinary Differential Equations: Introductions: First order equations, separation of variables, equation of homogeneous coefficients, integrating factors; Second order linear equations and its general solution; Second order equations with constant coefficients, undetermined coefficients, variations of parameters.

The Laplace Transform: Transforms of elementary functions, step functions and derivatives; Derivatives of transforms; The inverse transform; Shift theorems.

ELNG 1101 **PHYSICS FOR ENGINEERS**

(3 credits) Semester 1 Level I

Syllabus: Mechanics :Scalars and Vector, Rotation; Rotational inertia and its calculation for some symmetrical objects; Parallel and perpendicular axis theorem. Torque; work done by torque. Simple Harmonic Motion; Angular SHM in terms of torque and angular displacement; Differential equation of motion and its solution; application to pendulum and rotating disc.

Waves and Optics: Waves on Strings; the wave equation; phase velocity, the sine wave; power transmission; superposition principle; interface; standing waves and resonance.

Sound Waves: Wave speed; displacement and pressure waves; beats; Doppler effect. Optics: Huygen'Principle; the electromagnetic wave; coherence; Young's experiment; Thin film interference: Single and double slit diffraction; the phasor method; the diffraction grating.

Lasers: What are lasers? Introduction to the basic principle of operation; laser application in engineering.

Electricity and Magnetism: Electric field and potential: The electric field E due to extended charge distributions; Integral and differential expressions relating the electric potential V to the E field; Potential due to a dipole and other extended charge distributions.

Gauss' Law: Application to problems with spherical, cylindrical and rectangular symmetry.

Capacitance: Calculation of the capacitance of various capacitors; Energy stored in a capacitor; RC circuits; Time constant, Magnetism: Magnetic force on current-carrying wire and its application to cases needing calculus treatment; Magnetic torque on a current loop; Magnetic moment of a current loop; The Hall-Effect; Biot-Savart Law and Ampere's Law, and their application to long current-carrying wire, loop, and solenoid.

Electromagnetic Induction: Faraday's Law and Lenz's Law; Electro-magnetic induction and its applications; Self Induction; Inductance; RL circuits.Electromagnetic Oscillations and Alternating Currents: LC Oscillation; Damped oscillation in an RLC circuit; Alternating current; Forced oscillation; RLC circuits; Power in AC circuits; the Transformer; Introduction to the Electromagnetic wave.

Modern Physics: Bohr Atom: Spectral series for hydrogen, Bohr's postulates, derivation of energy levels, blackbody radiation and quantized energy levels (qualitative).

Waves & Corpuscles: Wave-particle duality; photo-electric effect; Compton-effect; energy, momentum and wavelength of a photon, DeBroglie's equation, wave function, particle in a box, nanocrystallites and quantum dots.

Electrical Conduction in Solids: Energy Levels in Crystalline solids; Insulators; Conductors; Semi-conductors; Doped Semiconductors; p-n junction.

Evaluation:	One 3-hour theory examination paper	70%
	Two 1-hour in-course tests (15 % each)	30%

COMP 1160 **OBJECT ORIENTED PROGRAMMING**

(3 credits) Semester 2 Level I

Prerequisites: ECNG1009

Syllabus: Class of objects; methods; members; message passing; encapsulation and information hiding; separation of behavior and implementation. Imperative control structures, assignment state, parameter passing models. Inheritance; polymorphism; class hierarchies. Interface vs. multiple inheritance. Templates/generics.Using APIs; class libraries. Module/packages; name space solution; primitive types; array, string processing; I/O processing; pointers and references; linked structures; strategies for choosingthe right data. Collection classes and iteration protocols; event-driven and concurrent programming; exception handling; Introduction to GUI programming; thread programming. OO testing; debugging tools.

Object-Oriented Methods: analysis and design, design for re-use; modeling tools, comparison of OOD and top-down/bottom-up design; intro to the concept and use of design patterns.

Evaluation:	One 2-hour written exam	60%
	One in-course test	10%
	Assignments	30%

ELET1400 **INTRODUCTION TO ELECTRONICS**

(3 credits) Semester 2 Level 1

Course Structure: Introduction to Semiconductor Theory and the P-N Junction (13 Hrs):

Review of the atomic structure and bonding; Energy level diagrams; Intrinsic and Extrinsic semiconductors; Electrical properties; the Fermi Dirac Distribution function; The P-N Junction and the diode; light emitting diodes (LED); The Bipolar Junction Transistor (BJT); the

Field Effect transistor; Biasing the transistor circuit; DC Transistor circuits.

Introduction to Digital Electronics (13 Hrs):

Analog and digital concepts; binary digits and logic levels; digital waveforms; logic gates and truth tables; Boolean algebra and logic simplification; DeMorgan's theorem; Circuit minimization; Terminologies used in logic designs; Combinational logic circuits: BCD; Latches, Flip-Flops; Memory circuits and devices; Simple programmable arrays: ADC and DAC Circuits.

Introduction to Analog Electronics and Communication Systems (13 hrs):

Introduction to alternating current (AC); Frequency dependent RLC circuits; Bandwidth and half-power. The Operational Amplifier and its applications; Fundamentals of analog and digital Communication Systems;

Evaluation:	One 2-hour theory examination paper	60%
	Two 1-hour in-course tests (2 x 20%)	40%

ELET1405 **PRACTICES IN BASIC ELECTRONICS**

(3 credits) Semester 2 Level 1

Course Structure: Week 1:Using lab equipment, resistor colour codes, lab safety.

Week 2: Diode characteristics and application to power supply circuits

Week 3: Transistor characteristics and circuit applications

Week 4: Optical semiconductor devices and their circuit application

Week 5: Semiconductor circuit design test. (in-class)

Week 6: TTL Logic and Boolean algebra

Week 7: Functions of Combinational Logic Circuit: Decoders

Week 8: Flip Flop and the 555 Timers

Week 9: Digital circuit design test (in-class)

Week 10: Ac operation of RLC Circuits

Week 11: Op Amp Circuits

Week 12: Investigating AM and FM communication circuits / systems

Week 13: Analogue Circuit Design test (in-class)

Evaluation:	Nine Laboratory reports (equal weighting)	15%
	Three design projects (3 x 15%)	45%
	One 2-hour final examination paper	40%

LEVEL 2

ECNG 2009 **CONTROL SYSTEMS**
(3 credits) Semester 2 Level 2

Prerequisites: ELNG1101 and MATH1180

Syllabus: Classical control of dynamic linear systems; solutions of linear differential equations using Laplace transform;, transfer function system representation, system response characteristics, error performance and tracking, the Evans root locus method for design of PID, lead and lag compensators, frequency response method using Bode, Nyquist and Nichols plots and stability margin issues.

Lab exercise in ELET2415.

MATH 2230 **ENGINEERING MATHEMATICS 2**
(3 credits) Semester 1 Level 2

Prerequisites: MATH1180 - Engineering Mathematics I

Ordinary differential equations; power series solution, Legendre's equation, Bessel equation. Laplace transform: convolution theorem; application to simple initial value problems and integral equations; periodic function.

Fourrier series: Euler's formulae; even and odd functions; half range expressions; solutions to some ordinary differential equation.

Partial differential equation: classification; tehone-dimension wave equation, the heat conduction and diffusion equation; Laplace's equation in cylindrical and spherical polar coordinates.

Vector calculus: scalar and vector fields; vector calculus; curves; arc length, tangent, curvature and torsion; directional derivatives, divergences and curl of a vector field; line integrals; surface integrals; Stoke's theorem and divergence theorem.

ELET2405 PRACTICES IN ELECTRONICS DESIGNS I

(3 credits) Semester 1 Level 2

Prerequisites ELNG1101, ELET1400 and ELET1405

Co-Requisite: Any level 2 Semester 1 Electronics or Electronics Engineering course

Course Structure: ***Investigative labs***:

Six lab exercises will be assigned that are consistent with the electronics courses that the student has undertaken for semester 1. A report of the results, analyses and discussions must be handed in at the end of each lab session.

Design Project:

A major electronics design project will be assigned to each student during the first two lab sessions. In some cases students will be required to work in pairs. In addition to working on their project during the assigned lab sessions, students are also expected to do the necessary background/research work outside of classes. A complete project report and demonstration of prototype must be formally presented at the end of the semester.

Evaluation:	Six Laboratory reports (equal weighting)	30%
	One major design project	70%

ELET2415 **PRACTICES IN ELECTRONICS DESIGNS II**

(3 credits) Semester 2 Level 2

Prerequisites**:** ELNG1101, ELET1400 and ELET1405

Co-Requisite: Any level 2 Semester 2 Electronics or Electronics Engineering course

Course Structure: *Investigative labs*:

Six lab exercises will be assigned that are consistent with the electronics courses that the student has undertaken for semester 2. A report of the results, analyses and discussions must be handed in at the end of each lab session.

Design Project:

A major electronics design project will be assigned to each student during the first two lab sessions. Students will be required to work in groups of 2 or 3. In addition to working on their project during the assigned lab sessions, students will be required to do the necessary background/research work outside of class times. A complete project report and demonstration of prototype must be formally presented at the end of the semester.

Evaluation:

Six laboratory exercise and reports	30%
One major design project	70%

ELET2410 **ANALYSIS AND DESIGN OF ANALOGUE CIRCUITS**

(3 credits) Semester 2 Level 2

Prerequisites ELNG1101 and ELET1400

Syllabus: Basic Concepts of Analog Circuits and Signals

Review of Diodes and their applications

Transistor circuits**:** AC analysis of transistor amplifiers, Feedback, multistage, RF, and Audio amplifiers; Differential amplifiers; Voltage regulation and regulator circuits

Operational Amplifiers: Op-Amp Responses, Op-Amp Circuits, Active Filters, instrumentation amplifiers

Linear integrated circuits: The phase lock loop, the 555 timer IC, Other linear ICs. Oscillators: Principles of oscillation, types of oscillators. Special-Purpose Amplifiers.Data conversion circuits

Evaluation:

One 2-hour final exam	60%
One 1-hour in-course tests	20%
Take home assignments	10%
One technical paper	10%

ELET2420 SEMICONDUCTOR DEVICES

(3 credits) Semester 2 Level 2

Prerequisites: ELNG1101 and ELET1400

Syllabus: Semiconductor Fundamentals: General introduction to semiconductor; Carrier modeling, energy quantization and probability concepts; energy bands structure, density of states, statistical mechanics; Semiconductor in equilibrium; Carrier transport and excess carrier phenomenon; Carrier Modeling; Carrier Action; Basics of device fabrications.

PN Junctions: PN Junction electrostatics; PN Junction Diode, I-V Characteristics, small signal admittance, Transient response; Optoelectronic Devices; microwave diodes – tunnel, IMPATT, Gunn. Bipolar Junction Transistors (BJT): BJT fundamentals, static characteristics, dynamic response modeling- equivalent circuits, transient response. PNPN Devices: Silicon controlled rectifiers (SCRs); TRIACS, DIACS. Metal Semiconductor contacts and the Schottky Diode. Circuit application examples for PN junction devices

Field Effect Devices: The JFET and the MESFET; The Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-theory of operation, ID-VD relationships, Threshold considerations; Non Ideal MOSFETs, Modern FET structures. Circuit application examples for Field Effect Devices

Evaluation:

One 2-hour final exam	60%

One 1-hour in-course tests	20%
Take home assignments	10%
One technical paper	10%

ELET2430 DIGITAL CIRCUITS AND MICROPROCESSORS

(3 credits) Semester 1 Level 2

Prerequisites: ELNG1101 and ELET1400

Syllabus: Digital Logic Design: Brief review of Combinational logic**;** Flip-Flops and Latches: Synchronous, Asynchronous, Single bit Memory elements, Counters & Shift Registers and Timing; System specification using State Diagrams; System design using state diagrams and flip-flops; The design of multidimensional memory arrays using flip-flops

Computer Arithmetic: Unsigned and Signed Integer Representation; Signed Magnitude Representation; One's Complement Representation; Two's Complement Representation; Floating-Point Representation; Fractions; Floating-Point Addition, Multiplication and Division

Processor Organization: Overview – RISC, CISC, Data Path, Control Unit; Operand Types; Addressing Modes; Instruction Types; Instruction Formats– zero, one, two and three address machines; Micro-program Control - Hardware and Software implementation, Data Path manipulation

Cache memory: Cache Design Basics; Mapping Function - Direct Mapping, Associative Mapping and Set-Associative Mapping; Policies; Write Policies; Cache management - Locating a Block and Replacement Policies

Parallelism: Pipeline - Basic Concepts; Handling Resource Conflicts; Hazards; Register Forwarding; Register Interlocking; Handling Branches - Delayed Branch Execution, Branch Prediction and Performance Enhancements; Superscalar Processors; Superpipelined Processors; Very Long Instruction Word Architectures; Example Implementations - Pentium and SPARC Processors; Vector processors

Interrupts: A Taxonomy of Pentium Interrupts; Hardware and Software Interrupts; Example implementations – Pentium and SPARC Processors

Evaluation:	One 2-hour final exam	60%
	One 1-hour in-course tests	20%
	Take home assignments	10%
	One technical paper	10%

ELET2450 EMBEDDED SYSTEMS

(3 credits) Semester 1 Level 2

Prerequisites: ELNG1101 and ELET1400

Syllabus: Embedded Systems Overview*:*Introduction and Background; Embedded System-On-Chip (SOC) and in VLSI Circuits.

Microcontroller Overview: Basic Layout; Components; Memory and Register; Instruction Set; The AVR 8-Bits Microcontrollers.

Assembly Programming & Simulation: Assembly Language Structure; Branch, Call and time delay loops; AVR Studio: Editor, Assembler, Simulator, Debugger and Hex Programmer; Simulation of Written Code; STK500 Hardware: Description and Operation; Actual Microcontroller Programming.

Digital & Analog Capabilities: Digital Input/Output Capabilities; Configuration and Operation of I/O Ports; Digital I/O Port Programming; Analog Input/Output Capabilities; Configuration and Operation of I/O Pins/Ports; Analog-to-Digital Conversion; Analog Peripheral Programming.

Interrupt Subsystem; Timing Subsystem; Serial Communication Subsystem.C Language for Embedded Systems: Operating Parameters & Interfacing:

Design & Development: Design Plans (Project Specifications, etc.; Sourcing and Selection of Controllers and Components; Designing Circuits; Flowcharts and Programs; Implementation and Packaging; Documentation.Communication Technology: Introduction to IrDA; Introduction to USB; USB Packets; USB Physical Interface; Implementing USB Interface

Evaluation:	One 2-hour final exam	60%

One 1-hour in-course tests	20%	
Take home assignments	10%	
One technical paper	10%	

ELET2460 SIGNALS AND SYSTEMS

(3 credits) Semester 1 Level 2

Prerequisites: ELNG1101 and ELET1400

Syllabus: CONTINUOUS-TIME SIGNALS AND SYSTEMS

Continuous-Time Elementary Signals: The Unit Step, the Unit Impulse, the Unit Ramp, Sinusoidal Signal. Signal Transformations: Continuity, Piece-wise continuity; Time shifting, time scaling, time reversal; Convolution; Convolution and Impulse Response. Introduction to systems; Frequency Domain Representation of Signals and Systems.Transform Domain Representation of Systems; Time Domain Analysis of Systems.

DISCRETE-TIME SIGNALS AND SYSTEMS
Mathematical Representation of Discrete-Time Signals; Frequency Domain Representation of Discrete-Time Signals; Comparison of Fourier Transforms. Time Domain Representation of Discrete-Time Systems: Transform Domain Representation of Discrete-Time Systems; Discrete-Time Systems; Stability of Discrete-Time Systems; Time Steady State Response; Filter Design: Analog Filters; Digital Filters (FIR and IIR Filters)

Evaluation:	One 2-hour final exam	60%
	One 1-hour in-course tests	20%
	Take home assignments	10%
	One technical paper	10%

ELET2480 MODERN COMMUNICATION SYSTEMS

(3 credits) Semester 2 Level 2

Prerequisites: ELNG1101 and ELET1400

Syllabus: Modulation Techniques: Amplitude Modulation; Angle Modulation; Sampling & Digital Modulation.

Baseband Data Transmission: Baseband transmission of digital data; Inter-symbol Interference (ISI); The Nyquist Channel; Baseband transmission of M-ary Data; The Eye Pattern; Bandpass modulation techniques; Binary Amplitude-Shift Keying; Phase-Shift Keying; Frequency-Shift Keying; M-ary digital modulation schemes

Random Signals and Noise: Probability and random variables; Gaussian random variables; Random processes; Gaussian processes; White noise; Narrowband noise Noise in Analogue Communications; Noise in Digital Communications:

Wireless Communication: Propagation loss in a simple wireless link; Principles of Radio and Television; Facsimile; Cellular technology and Global Positioning Systems (GPS); Brief Introduction to GSM technology

Evaluation:

One 2-hour final exam	60%
One 1-hour in-course tests	20%
Take home assignments	10%
One technical paper	10%

LEVEL 3

Please note that all Level III courses will be offered in the 2011/2012 academic year.

ELNG 3010 SPECIAL PROJECT
6 credits Year-Long Level 3

Prerequisites: ELET2405 and ELET2415

Syllabus: Special project will be undertaken by all students under the supervision and direction of academic staff in conjunction with an engineering supervisor from an associated Industry. The project will be Industry based and students work very closely with their industrial partners. Project details will be provided in a Project Handbook.

ECNG 3021 **INTRODUCTION TO ENGINEERING MANAGEMENT AND ACCOUNTING SYSTEMS**

4 credits Semester 1 Level 3

Syllabus: Accounting and finance: Introduction to finance accounting, financial statements and analysis; time values of money; NPV and DCF; capital budging cash flows and techniques. Management and Organizational Theory: Theory of organization; motivation; leadership; communication; human resource development/strategic planning; organizational development and change. Production management, planning and control; project management, PERT, CPM, project evaluation; quality management. Introduction to Business Law: Formation of companies and general legal requirements; general principles of Contract and Tort; Law of Agency; Sale of goods and Hire Purchase Act.

MGMG 3136 **NEW VENTURE CREATION AND ENTREPRENEURSHIP**

3 credits Semester 2 Level 3

Syllabus: This course deals with one of the most challenging issues confronting developing countries. It focuses on understanding and appreciating the entrepreneurial mindset in relation to the ability to create new ventures successfully. The course also focuses on "intrapreneurship" or in the reinvigoration of existing enterprises with an attitude of innovation, responsiveness and receptivity to change, and it considers entrepreneurship in an international context.

PHYS 3385 **ELECTROMAGNETISM**

4 credits Semester 2 Level 3

Prerequisites: ELNG1101 and MATH2230

Syllabus: Derivation of Maxwell's equations in differential form. Equation of continuity.Poisson's equation.Derivation of the electro-magnetic wave equation. Solution for plane waves in dielectrics. Electro-magnetic nature of light.Energy flow and the Poynting vector.Boundary conditions.Reflection and refraction of electro-magnetic waves at dielectric boundaries.Derivation of Snell's law. Fresnel's equations.Total reflection.Brewster's angle.Transmission and reflection co-efficients.Propagation of electro-magnetic waves in conducting media.Skin depth.Energy flow in conductors. Reflection of

Electro-magnetic waves by a conductor. Dispersion of electro-magnetic waves in various media.Sources of Electromagnetic waves.

ELET 3480 **WIRELESS COMMUNICATION**

3 credits Semester 1 Level 3

Prerequisites: ELET2480

Syllabus: Introduction to wireless communication systems; Modern Wireless communication systems: 2G, 2.5G and 3G technologies; intro to 4G technologies; The cellular concept: system design fundamentals. Mobile radio propagation: Large scale path loss; small scale fading and multi-path. Modulation techniques for mobile radio; Equalization, Diversity and Channel coding; Speech Coding; Multiple access techniques for wireless communications; Wireless networking; Wireless systems and standards. (Text: Wireless Communications: Principles and Practice – by T.S Rapapport; Prentice Hall Publications, 2002)

ELNG 3050 **BROADBAND NETWORKS**

3 credits Semester 2 Level 3

Prerequisites: ELET2480

Syllabus: Orthogonal Frequency Division multiplexing and other block based transmissions; Multiple input – multiple output antenna systems (MIMO); Ultrawideband systems; Medium Access control; Mobility Resource Management; Routing protocols for multi-hop wireless broadband networks; Radio resource management for wireless broadband networks; Quality of service for multimedia services; Long term evolution of Cellular networks; Wireless broadband networking with WIMAX; Wireless Local Area Network; Convergence of networks (Text: Wireless Broadband Networks – by David Tung Chong Wong, et al; Wiley and Sons – 2009))

ELET 3412 **INSTRUMENTATION AND MEASUREMENTS**

3 credits Semester 1 Level 3

Prerequisites ELET2410 or ELET2460

Syllabus: Measurements systems: measurement system architecture; errors; standards. Analogue Signal Conditioning: differential amplifiers; instrumentation amplifiers; active filters; nonlinear analog signal processing; charge amplifiers; phase sensitive rectifiers.

Noise and Coherent Interference in Measurements: Random noise in circuits; Gaussian noise through linear filters; Broadband noise factor and noise figure; Modern low noise amplifiers for use in instrumentation; coherent interference and its minimization.

DC Null Measurements: Wheatstone bridge; Kelvin bridge; the Anderson constant current loop; potentiometers. AC Null Measurements: AC bridges.

Sensors and sensor input mechanism: resistive sensors; voltage generating sensors; variable magnetic coupling; capacitive; fiber optic; optical sensors; ionizing radiation; electrochemical; electronic noises; Mechano-optical.

Application of sensor to physical measurements: Case studies. Basic Electrical Measurements.Digital Interfaces in Measurements Systems.Digital Signal Controllers. Case Studies of the design of measurement systems.

ELNG 3030 **POWER ELECTRONICS AND PROTECTION CIRCUITS**

3 credits Semester 1 Level 3

Prerequisites: ELET2410 and ELET2420

Syllabus: Power semiconductor devices: SCRs, TRIACS, DIACS, and Applications. Single and 3-phase AC to DC Converters.Single and 3-phase DC/AC Inverters; Switched and Resonant DC/DC Converters. Single and 3-phase AC Power Controllers. Applications: UPS, Electronic Ballast, Motor Drive, Armature voltage control, field current control, High voltage DC (HVDC) Transmission, Induction Heating; Electric Welding;

Fuse and circuit breakers; Electromagnetic relays; Solid State Relays; Optical Isolators; Over-voltage protection – MOVs. Over-current protection; Circuit cooling;

ELNG 3040 **INDUSTRIAL AUTOMATION**

3 credits Semester 1 Level 3

Prerequisites: ECNG2009 and ELET2450

Syllabus: Plant wide Control Systems and Automation Strategy: Evolution of instrumentation and control, Role of automation in industries, Benefits of automation; Automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, performance criteria, Safety Systems. Advance Applications of PLC and SCADA: PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU).

Instrumentation Standard Protocols.Distributed Control Systems (DCS) Basics: DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, Latest trends and developments. Distributed Control Systems Engineering and Design. Application development and Automation for industry verticals: Application development and automation for following industries. Power, Water and Waste Water Treatment, Food and Beverages, Cement, Pharmaceuticals, Automobile and Building Automation.

ELNG 3060 **POWER PLANT INSTRUMENTATION**

3 credits Semester 2 Level 3

Pre/Co-Requisites: ELET3430 / ELNG3040

Syllabus: Power plant: Unit, overview, Types of boiler, Exhaust Gas Boilers and Incinerators, turbine generators, condensers, material handling systems. Comparison of thermal power plant, hydroelectric power plant, Nuclear power plant, solar power plant, Wind power plant.

Boiler Instrumentation: Control and optimization, Combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, oxygen/CO2 in flue gases, furnace draft, boiler interlocks, sequence event recorder, supervisor control, data acquisition controls, burner management systems and controllers. Start-up and shut-down procedures, Boiler safety standard, Boiler inspection procedures.Boiler load calculation, boiler efficiency calculation. Instrumentation for Boiler ancillaries viz. water treatment, electro-static precipitator, soot blower, economizer, de aerator, super heater, chemical dosing systems, air pre-heater, coal

and ash handling systems, fuel storage and distribution, Bag House Filters.

Turbine instrumentation and control, start-up and shut-down , thermal stress control, condition monitoring & power distribution instrumentation. Synchronous, Induction generators.

Hydroelectric power generation, regulation & monitoring of voltage & frequency of output power.Pollution & effluent monitoring & control. Energy Management, electrical sub-station controls. Power Generation using non-conventional energy sources viz. Wind Power, solar Power, Tidal Power, Plant safety & redundancies. Nuclear Power Generation & control Station. Diesel Generator Controls

Registration Guideline

Please refer to the relevant Faculty Handout.

Time Tables for Academic Year 2011-12

NB: Timetables may be subjected to modifications

Lecturers Initials

PA - Paul Aiken	SD - Samuel Daniels	PS - Patrick Stephens
LM - Leary Myers	HM - Hilton McDavid	DB - Davide Batic
AC - Andre Coy	EL - Ervin Lyle	CL - Claudia Lewis
LC - Leonardo Clarke	RW - Rhodene Watson	PP - Peter Palmer
CA - Chad Andrade	AT - Ashley Taylor	TBD - To be Determined

Level 1 Electronics Engineering Time Table 2011-12

Sem	Time	Monday	Tuesday	Wednesday	Thursday	Friday
1	8:00 - 9:00 AM	ELNG1101 Lect (Phys Rm A) (RW)	ECNG1009 Lect (V. Lab) (TBD)	ELNG1101 Lect (Phys Rm A)	MATH1180 (Math LT 1)	ECNG1009 Lecture (V. Lab)
	9:00 - 10:00 AM	ELNG1101 Lect (Phys Rm A) (RW)	ECNG1009 Lect (V. Lab) (TBD)	ELNG1101 Tut (Phys Rm A)	MATH1180 (Math LT 1)	ECNG1009 Tutorial (V. Lab)
	10:00 - 11:00 AM	MATH1180 (Bio Lect T) (PP)		ECNG1000 Lect (Phys A)	ELNG1101 Engineering Physics Lab (RW)	ECNG1000 Lect (Phys A) (LM)
	11:00 - 12:00 PM	MATH1180 (Bio Lect T) (PP)	ECNG1009 Introduction to Programming Lab (CA)	MATH1180 (Chem LT 2)		ENGR1000 Lect (Intro to Eng)
	12:00 - 1:00 PM			MATH1180 (Chem LT 2)		ENGR1000 Tutorial (Intro to Eng)
	1:00 -2:00 PM				IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS)	
	2:00 - 3:00 PM	ENGR1000 Lect (Intro to Eng) (PS)	ECNG1000 Lecture (Phys A)	ENGR1000 Lect (Intro to Eng)		
	3:00 - 4:00 PM		ECNG1000 Tutorial (Phys A)			
	4:00 - 5:00 PM					
2	8:00 - 9:00 AM				ECNG1012 Lect (Sci of Materials) (RW)	ECNG1012 Lect (Eng Graphics) (TBD)
	9:00 - 10:00 AM	ELET1405 (Tutorial and Laboratory Session) **Stream A** (TBD)		ELET1400 Lect (Phys Rm A)	ECNG1012 Tut (Sci of Materials) (RW)	ECNG1012 Tut (Eng Graphics) (TBD)
	10:00 - 11:00 AM		ELET1400 Lect (Phys Rm A)		ECNG1012 Electrical Circuits Lab and Design Project (PA)	ECNG1012 Engineering Graphics Lab (TBD)
	11:00 - 12:00 PM		ECNG1012 Lect (Fluids) (TBD)			
	12:00 - 1:00 PM		ECNG1012 Tut (Fluids) (TBD)	COM1161 Lect (C5) A. Taylor		
	1:00 -2:00 PM	COM1161 Lect (C5) A. Taylor	ELET1405 (Tutorial and Laboratory Session) **Stream B** (PA)	COM1161 Lect (C5) A. Taylor	IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS)	ELET1405 (Tutorial and Laboratory Session) **Stream C**
	2:00 - 3:00 PM	ECNG1012 **LAB Stream A** (Workshop Technology / Science of Materials / Mechanics of Fluids) (BM)		ECNG1012 **LAB Stream B** (Workshop Technology / Science of Materials / Mechanics of Fluids) (BM)		
	3:00 - 4:00 PM					
	4:00 - 5:00 PM					
	5:00 - 6:00 PM	ELET1400 Lecture (LM /PA)	ELET1400 Tut (Phys Rm B)	ELET1400 Tut (Phys Rm B)		

Level 2 Electronics Engineering Time Table

Sem	Time	Monday	Tuesday	Wednesday	Thursday	Friday
1	8:00 - 9:00 AM	MATH2230 Tutorial (Math Lect 3)		MATH2230 (Math Lect 3)	MATH2230 (Math Lect 3)	
	9:00 - 10:00 AM	ELET2430 Lecture (Phys Rm B)	ELET2405 Tutorial (level 2 el lab)	ELET2405 Tutorial (level 2 el lab)	MATH2230 (Math Lect 3)	
	10:00 - 11:00 AM	ELET2460 Lecture (Phys Rm A)	ELET2450 Lecture (Virtual Lab)	ELET2460 Lecture (Phys Rm A)	ELET2450 Lecture (Phys Rm A)	ELET2430 Lecture (Phys Rm B)
	11:00 - 12:00 PM	ELET2450 Lecture (Virtual Lab)	ELET2460 Lecture (Phys Rm A)			
	12:00 - 1:00 PM					
	1:00 -2:00 PM	ELET2405 (Laboratory Session) level 2 Electronics Lab. Stream **A**	MATH2230 (Math Lect 3)	ELET2405 (Laboratory Session) level 2 Electronics Lab. Stream **B**	IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS	
	2:00 - 3:00 PM		MATH2230 (Math Lect 3)			ELET2450 Tutorials (Phys Rm B)
	3:00 - 4:00 PM					
	4:00 - 5:00 PM	ELET2460 Tutorial (Phys Rm A)	ELET2430 Tutorial (Phys Rm B)	ELET2430 Lecture (Phys Rm B)		
	5:00 - 6:00 PM					
2	8:00 - 9:00 AM				ELET2420 Lect (Phys Rm A)	
	9:00 - 10:00 AM	ELET2410 Lect (Phys Rm A)	ELET2415 Tutorial & Teaching Laboratory Session Level 2 Electronics Lab. Stream B			ECNG2009 Lect (Phys Rm D) Control Systems
	10:00 - 11:00 AM			ELET2420 Lect (Phys Rm B)	ELET2480 Lect (Phys Rm A)	
	11:00 - 12:00 PM					
	12:00 - 1:00 PM			ELET2410 Lect (Phys Rm B)		ELET2410 Lect (Phys Rm B)
	1:00 -2:00 PM	ELET2415 Tutorial & Teaching Laboratory Session Level 2 Electronics Lab. Stream A		ELET2415 Tutorial & Teaching Laboratory Session Level 2 Electronics Lab. Stream C	IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS	ELET2480 Lect (Phys Rm B)
	2:00 - 3:00 PM					
	3:00 - 4:00 PM		ELET2420 Lect (Phys Rm A)			
	4:00 - 5:00 PM		ELET2420 Tutorial (Phys Rm B)			
	5:00 - 6:00 PM	ELET2480 Lect (Phys Rm A)	ELET2480 Tutorial (Phys Rm A)	ELET2410 Tutorial (Phys Rm D)		

Level 3 Electronics Engineering Time Table

Sem	Time	Monday	Tuesday	Wednesday	Thursday	Friday
1	8:00 - 9:00 AM		ECNG3021 Tut (Phys B) H.M			
	9:00 - 10:00 AM	ELET3470 Lecture (Phys C) TBD		ELET3430 Lecture (Phys C) P.A		ELNG3040 Lect (Phys D) Industrial Automation - E. Lyle
	10:00 - 11:00 AM	ELET3430 Lect (Phys B) P.A	ELET3470 Lecture (Phys C) TBD	ELET3470 Lecture (Phys C) TBD	ELNG3030 Lecture (Phys A) P.A.	
	11:00 - 12:00 PM	ECNG3021 Lect (Phys B) H.M.	ELET3430 Lecture (Phys B) P.A	ELNG3030 Lecture (Phys D) P.A.	ELET3480 Lecture (V. Lab) TBD	
	12:00 - 1:00 PM	ELET3480 Lecture (Phys A) A.C.	ECNG3021 Lect (Phys B) H.M.	ELNG3030 Tutorial (Phys D) P.A.	ELET3480 Tutorial (V. Lab) TBD	ELNG3040 Tutorial (Phys D) E.L
	1:00 -2:00 PM	ELET3405 Tutorial and Laboratory Stream A		ELET3405 Tutorial and Laboratory Stream B	IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS	ELET3405 Tutorial and Laboratory Stream C
	2:00 - 3:00 PM		ELNG3030 Lecture (Phys D) P.A.			
	3:00 - 4:00 PM		ELET3480 Lecture (V Lab) TBD			
	4:00 - 5:00 PM		ELET3430 Tutorial (Phys B) P.A			
	5:00 - 6:00 PM			ELET3470 Tutorial (V. Lab) TBD		
2	8:00 - 9:00 AM		ELET3450 Lecture (Phys A) TBD	ELET3485 Lecture (Phys A) L. C.		
	9:00 - 10:00 AM	ELET3485 Lecture (Phys A) L. C.			ELET3460 Lecture (Phys B) A. C.	
	10:00 - 11:00 AM	ELET3450 Lecture (Phys A) TBD		ELET3460 Lecture (Phys B) A. C.		ELET3450 Lecture (Phys C) TBD
	11:00 - 12:00 PM	ELET3460 Lecture (Phys B) A. C.	ELET3460 Tutorial (Phys B) A. C.			ELET3485 Lecture (Phys A) L. C.
	12:00 - 1:00 PM			PHYS3385 Lecture (Phys C) S. Daniels		PHYS3385 Lecture (Phys C) S. Daniels
	1:00 -2:00 PM	Laboratory Session ELET3385 - Electromagnetism	ECNG3020 Project Lab Session		IEEE Students Club Activities (ALL ELECTRONICS ENGINEERING STUDENTS	
	2:00 - 3:00 PM					ELET3485 Tutorial (Phys A) L. C.
	3:00 - 4:00 PM			Projects Meeting		
	4:00 - 5:00 PM			ELET3450 Tutorial (Phys A) TBD		
	5:00 - 6:00 PM	ECNG3028 Tutorial (Phys D)	ELNG3050Tutorial (Phys D)	ELNG3060Tutorial (Phys D)		
	6:00 - 9:00 PM	ECNG3028 Lecture (Phys D) TBD1	ELNG3050 Lecture (Phys D) TBD2	ELNG3060 Lecture (Phys D) TBD3		