Bachelor of Engineering in Electronics Programme – Courses at a Glance

Level 1 Courses

ENG101 ANALOGUE ELECTRONICS DESIGN

Semiconductor devices and integrated circuits are the backbone of modern technology. This course provides students with a thorough understanding of analogue electronics principles, components and systems, which form the foundation of this technology. ENG101 teaches the principles of electronics components that are the basic building blocks, and also the application of appropriate mathematical methods of modelling of components and circuits. It is an integral part of undergraduate curriculum for students majoring in electrical or computer engineering and shall deliver the essential concepts through both the theoretical and practical know how as needed in this field of engineering.

ENG103 DIGITAL ELECTRONICS DESIGN

Upon the completion of the Digital Electronics Design course, students will be able to perform analysis and design of digital circuits. The course teaches the principles of digital circuit components that are the basic building blocks, and also the application of appropriate mathematical methods for modelling components and circuits.

ENG105 DESIGN OF LOGIC SYSTEMS

The central theme of this course is the analysis, specification and design of a wide variety of digital circuits. Students will learn the theory and application of logic design methods, and use computer-based design packages widely employed in industry. They will undertake design exercises, translating system specifications into circuits that could then be simulated on the computer.

ENG107 INTELLECTUAL PROPERTY AND PATENTS

The course introduces engineering students to the importance of understanding the characteristics and applications of Intellectual Property and Patents. Industry examples of case studies will be deployed in the teaching/student assessment of performance in the course.

MTH102e TRANSFORMATIONS AND MATRICES

MTH102 is part of a foundation suit of level 1 courses designed to provide students with a broad foundational set of mathematical skills and techniques. The course will prepare students for both higher level mathematical studies as well as the study of other and related subjects that
contains mathematical content.

**MTH104e CALCULUS AND ALGEBRA**

This course extends the calculus introduced in MTH103, and introduces a number of abstract algebraic structures. Complex numbers, congruences and some basic group theory are introduced. Various methods of proof, such as mathematical induction, are discussed.

**SST101e PRINCIPLES OF PROJECT MANAGEMENT**

SST101e Principles of Project Management will provide both theoretical and practical insights on the management of projects. Students will be taught the characteristics of different industries, and how project management skills apply in them. These give undergraduates a solid foundation in the appreciation and application of project management. It prepares them for an in-depth understanding of project management in science and technology.

**Level 2 Courses**

**ENG201e LINEAR SYSTEMS ANALYSIS & DESIGN**

ENG201e Linear Systems Analysis & Design provides a theoretical foundation for the analysis of electronic systems and their processed signals. Topics include the basic mathematical properties of electronic signals and systems, identifying the correct mathematical tools to analyze and synthesize signals, and using a computer simulation model to look at time/frequency domain behavior of signals and systems.

**ENG203 FILTER THEORY AND DESIGN**

Filter Theory and Design is a level 2 course which follows the prerequisite course ENG201e (Linear System Analysis and Design). It addresses basic knowledge of system analysis and modelling, the theory of filters and design techniques for analog and digital filters based on the theories of signals and systems introduced in course ENG201e. Filters are essential components which are extensively used in various electronic systems. Comprehension and mastery of filter theories will be necessary to achieve expected performance in electronic system design. This course also serves as the prerequisite for other coursework in the areas of signal processing and communications engineering.

This course is to provide a theoretical foundation and some practical experience for analog and digital filters design in electronic systems and signal processing techniques.

**ENG231e ENGINEERING ETHICS**

Nowadays, technology has a pervasive and profound impact on everyday life, where engineers play a crucial role in its development. It is therefore extremely important that engineers
understand the importance of safety, health, and welfare of the public, when developing this technology. They must be morally committed and equipped to tackle any ethical issues they may encounter. This course aims at training the student to reach such a status through discussions and typical case studies where real examples are thoroughly discussed.

**ICT271 INTRODUCTION PROGRAMMING TECHNIQUES IN C++**

This course introduces the design and development of computer programs to solve problems. Topics include the fundamental programming constructs as well as using the taught software development procedure to implement applications using C++ language.

**ICT272 OBJECT ORIENTED PROGRAMMING IN C++**

This course introduces the fundamental object-oriented concepts. Topics include object-oriented features including Class, Objects, Encapsulation, Inheritance and Polymorphism, and implementing applications using C++ language.

**MTH211e FUNDAMENTALS OF MATHEMATICAL METHODS AND MECHANICS**

MTH211 is concerned with the use of mathematics to solve real-world problems. Part of it deals with the representation of relevant aspects of the real world in the form of mathematical models; another part is concerned with the mathematical methods that are useful in working with these models. The material of the course is organized in a way that reflects these broad divisions. By far the most important element of the models part of the course is the study of Newtonian mechanics. Newtonian mechanics is the basic source of models of the motion of objects of ordinary size moving with ordinary speeds (or not moving at all), and it underpins much of physical science and mechanical engineering.

**MTH215e FURTHER MATHEMATICAL METHODS AND MECHANICS**

MTH215 focuses on the use of matrix algebra and related structures to model complicated and coupled motions. The powerful techniques of linear algebra and calculus are fully exploited to solve a large class of problems arising from real-life scenarios.

**MTH217e NUMERICAL METHODS AND ADVANCED CALCULUS**

MTH217 considers more advanced techniques to solve various problems in applied mathematics, and prepares students for higher level 3 studies in applied mathematics.

**MTH219e FUNDAMENTALS OF STATISTICS AND PROBABILITY**

Students are exposed to the essential and important concepts of Statistics and Probability for data analysis. Illustrative examples in various discipline will be discussed. Emphasis will be on understanding data variability and uncertainty; cultivating statistical thinking and applying
statistical techniques to solve real-life practical problems. Descriptive statistics and useful probability models will be introduced.

**Level 3 Courses**

**ENG301e MICROPROCESSOR PROGRAMMING**

ENG301e, Microprocessor Programming is intended to introduce the programming fundamentals of the ARMv7 microcontroller system, its instruction set, and the programming/control of ARMv7 based systems through the use of various LabVIEW functions. To enhance the understanding and application of ARMv7 microcontroller, the classical ARM architecture and assembly language programming, ARM organization and implementation and architecture support for system development are comprehensively discussed.

**ENG303 REAL TIME SYSTEMS**

This course covers embedded real-time systems design. Topics include the description/application of embedded systems, embedded system architectures, programming concepts, inter-process communication and synchronization, real-time operating systems, and design methodology. Applications will be introduced using appropriate programming models or simulation tools.

**ENG305 COMPUTER COMMUNICATIONS**

Computers are a combination of complex digital systems. Each computer controls and communicates with its internal sub-systems through digital signals at high speed and precision. The power of computers are multiplied many folds when they are linked up through communication channels to form computer networks. Again the reliability and speed at which they communicate with one another determines the usefulness and capability of the computer network to share information and perform remote control functions across greater distances almost instantaneously. This course ENG305 lays down the fundamental understanding of the ways and methods computers used to communicate with one another and within networks, even though the computers may be made from different hardware technologies and run on diverse software platforms. Essential data communication will be covered and also in a bigger picture the basic mechanisms of computer communication within a local area network and internetworks will be taught. There will be also laboratory activities and a mini-project to enhance the understanding of the concepts and encourage hands-on application.

**ENG307 DIGITAL COMMUNICATIONS**

This course provides a comprehensive introduction to basic principles and fundamental theories of digital communication. Some important concepts are covered such as power spectral density
and energy spectral density of signals, digital signalling technique, Inter-symbol interference, various modulation schemes and probability of error etc.

This course is intended to develop an understanding of the fundamental principles of digital communication systems, help students accumulate knowledge and lay a good foundation for future and further studies or application in engineering fields of digital communications.

**ENG311e DIGITAL SIGNAL PROCESSING**

This course aims to equip students with the basic concepts and knowledge in Digital Signal Processing covering analytical and design concepts, methods and considerations for practical implementation. In the first part of this course, the main characteristics of discrete signals, properties of linear time invariant systems (LTI), z-transform and its properties, and frequency analysis of discrete-time signal are introduced. In the second part of this course, discrete time Fourier transform and realization of digital filters are presented. Design of FIR (Finite Impulse Response) and IIR (Infinite Impulse response) filters will be treated in the last part of this course. Besides being theoretical on the analytical skill set & methodology, student will also be given the opportunity to work on Industrial well-known Signal Processing Tools in lab session, such as MATLAB (and/or with real Target Digital Signal Processor).

**ENG313 ADAPTIVE SIGNAL PROCESSING**

Adaptive Signal Processing (ASP) is an area of science and engineering that has developed rapidly over the past 20 years, especially with the significant advances in research and development into high performance & high speed Digital Signal Processor as well as FPGA technologies. This course aims to equip participants with the fundamental skill set, basic analysis methodology and design techniques for adaptive digital processing of signals.

In general, the course provides the fundamental platform for student to pursue and build the strong foundation for module like “Digital Communication”, and other Communication related modules. Besides being theoretical on the analytical skill set & methodology, participants will also be given the opportunity to work on Industrial well-known Signal Processing Tools, such as MATLAB (and/or with real Target Digital Signal Processor). With such practical Industrial software packages, participants will be equipped with the practical aspect of the ASP or ADSP solutions design & implementation/realization.

The beginning of the module get directly into multi-rate signal processing, where discussion on varies aspect of sampling domain and principle of sampling frequency, where build on the fundamental of Signals & Systems theory. Immediately following that would be linear prediction and linear combiner solution, where discussion on stationary random process provides a fundamental understand of statistical prosperities of signal. Discussion on Autoregressive process and Moving Average process will then be focused, and finally get into Autoregressive Moving Average process. Power spectrum estimation and energy density spectrum of random signal will also be studied in the following chapter. Finally, analysis of Lease Means Square
(LMS) algorithm for linear combiner, and convergent rate, steady state error, etc will also be focused.

**ENG315e WIRELESS COMMUNICATION SYSTEMS**

This course is intended to give an introduction to the science and engineering of wireless communications. The course introduces the basic concepts and algorithms for the design of a practical wireless communication transceiver and the challenges introduced by the propagation environment.

**MTH309e NONLINEAR OPTIMISATION METHODS AND APPLICATIONS**

Optimization models are considered that are represented by constrained and unconstrained nonlinear functions. The various numerical solution techniques widely used to solve the nonlinear optimization models are covered. The computer software accompanying this course is used as a powerful tool to solve various nonlinear optimization models.

**Level 4 Courses**

**ENG499 CAPSTONE ELECTRONICS PROJECT**

This project course requires the analysis and synthesis of problems in the disciplines of electronics engineering and application of the various principles learnt to solve practical electronics design problems in an academic manner under the supervision of a project tutor. The project may take any one or a combination of the following forms: feasibility study, product development, computer modelling and analysis, design and construction, testing and experimental investigation. The project thesis is submitted individually.

**Elective Courses**

**ENG207e ENGINEERING ECONOMICS AND ANALYSIS**

Engineers regularly have to choose between different engineering project proposals. e.g. Which projects are worthwhile? Which project should have higher priority? Is one design better than another in terms of long term and short term cost trade-off’s?

Projects require money that has to be disbursed at different times to design and build, and after they are built, revenues or benefits occur, usually for years. Engineering Economic Analysis aims to help engineers understand the implications of their decisions on the use of limited capital resources, taking into account the time-value of money, and provides techniques for engineers to perform analyses and comparison between different alternatives.
This course also gives the engineer a basic knowledge to understand financial statements, ratio analysis, depreciation and alternative analysis methods in judging if a project is worthwhile.

The course is specifically tailored and approached from an engineering prospective for engineers, and therefore will defer from the conventional economic courses usually offered to business students.

**ENG319e ANALOGUE CONTROL SYSTEM DESIGN**

This course covers aspects of analogue control system design and modeling. Topics in the course include analogue mathematical modeling of control/feedback systems; classical control system analysis and frequency domain design techniques taking into consideration aspects of stability and performance.

The Aims of this course are to teach students the basics of classical control theory to evaluate systems stability and performance and when required to design controllers to stabilize and to improve performance of systems and on the practical implementations of feedback control systems.

Students will spend approximately 120 hours on a progressive basis to master the concepts and practice of control systems design in a Blended Learning mode. In addition, all face-to-face laboratory sessions provide students an opportunity to apply the concepts they have learnt.

This course provides students with the analytical tools to understand systems from a control engineering perspective and the tools and technologies to solve such problems.

It guides students to identify relevant system properties and parameters and to formulate mathematical models that allow the use of classical control theory to evaluate system performances and to design feedback control solutions to meet performance specifications.

It can be applied to sensors and transducer systems, to modelling and understanding of biomedical systems as well as in the manufacturing of batch products (pharmaceutical and drugs), discrete components and systems (disk drives, automation and MEM) and flow processes (petrol-chemical and oil and gas).

Students will also be introduced to Computer Simulation Design Tools such as Matlab and the associated Quanser Servomotor System.

**ENG321e DIGITAL CONTROL SYSTEM DESIGN**

This course provides students with the analytical tools to understand systems from digital control engineering perspective and the tools and technologies to solve such problems.
It guides students to identify relevant system properties and parameters and to formulate mathematical models that allow the use of either classical or modern control theories to evaluate system performances and to design feedback control solutions to meet performance specifications. It can be applied to sensors and transducer systems, to modeling and understanding of biomedical systems as well as in the manufacturing of batch products (pharmaceutical and drugs), discrete components and systems (disk drives, automation and MEM) and flow processes (petrol-chemical and oil and gas).

Students will also be introduced to Computer simulation Design Tools such as Matlab/Quanser.

**ENG323 ELECTRONICS MATERIALS**

This course introduces the fundamentals of semiconductors, dielectric and magnetic materials. Topics include the basic properties of semiconductor, carrier generation, transport and recombination, polarization in material, dielectric phenomena, properties of capacitors, piezoelectric effects, mechanism of magnetization, and the types of magnetic materials and their properties. You will also learn about the processes used in the selection of materials for capacitors and magnetic sensors and their applications.

**ENG325 SEMICONDUCTOR DEVICES**

This course covers the principles of operation of various semiconductor electronic and photonic devices, and their fabrication and applications. Topics include the fundamental physical principles of semiconductor/metal contacts/junctions, the use of mathematical models to describe the physical behavior of BJTs, MOSFETs and junction FETs, and the operation and construction of optoelectronic devices (LEDs and solar cells).

**ENG327e VLSI DESIGN 1**

The course takes you through the processes of implementing a silicon chip from the physical definitions through to the design and simulation of the chip’s functions. Emphasis is focused on building an understanding of integrated circuit (IC) design from the bottom up and includes important topics such as the characteristics of CMOS transistors, the CMOS processing technology, the IC design methodologies, the physical implementation of combinational and sequential logic network, and the physical routing and placement issues, which are essential to the practice of VLSI design as a system design discipline. Computer aided design (CAD) and simulation packages will also be introduced to you in the areas of digital and analog signal design and simulation. These tools are used to layout the circuit designs, to predict the circuit performance and to verify the correctness of the circuits and logic.

**ENG328e VLSI DESIGN 2**

This course is a continuation of VLSI Design I (ENG327e). You are expected to have grasped all basic understanding on MOS transistors and CMOS process flow. ENG328e extend the knowledge you had gained in ENG327e, to embark on the designing process of advanced logic
circuits. The course takes you through the processes of designing combinational and sequential logic circuits. Emphasis is focused on building an understanding of difference design styles, the IC design methodologies, the physical implementation of combinational and sequential logic network, and the physical routing and placement issues, which are essential to the practice of VLSI design as a system design discipline. Computer aided design (CAD) and simulation packages will also be introduced to you in the areas of digital and analog signal design and simulation. These tools are used to layout the circuit designs, to predict the circuit performance and to verify the correctness of the circuits and logic.

**ENG330 RADAR SYSTEM APPLICATIONS**

Radar systems find applications in daily living from traffic speed monitoring to inspection processing in quality assurance of goods to the safe guidance of aircraft flying in local/international airspaces, as well as for take-offs and landings from airports/airbases. This course introduces students to the fundamentals of radar principles from both a theoretical and practical perspective. Laboratory training with a scaled working analogue and digital radar system will be used to reinforce analytical modeling in seminars. Exercises using MATLAB in radar modeling will also be given as a part of the continuous assessment.

**ENG333 RF AND MICROWAVE DESIGN OF WIRELESS SYSTEMS**

This course reviews some fundamental principles of high frequency RF and microwave networks. Discussion of system parameters for various components that form building blocks for a wireless receiver system. They include amplifiers, oscillators, mixers, filter and antennas. Design approaches of all the blocks will be discussed in detail. A chapter on modulation methods allows the students to understand and characterize the wireless system from an input data stream through the transmitter, antennas and propagation channel, and the receiver. After completing the course, the students should be able to design a receiver for a wireless application system and evaluate the system performance.

**HFS351 SAFETY MANAGEMENT AND AUDIT**

This course covers important topics in managing and auditing safety in the workplace. Students will be taught the importance of safety policy and culture at work and how best to implement and communicate these policies to the workforce. The different quality management standards are also explored. Students are also taught the processes of developing a safety audit system, how to plan and implement an audit and also how to prepare an audit report.

**HFSY357 ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT**

A set of international standards is required to bring a world-wide focus to the environment, encouraging a cleaner, safer, healthier world for us all. The existence of the standards allows organizations to focus environmental efforts against an internationally accepted criterion. This course covers environmental systems, environmental audit, environmental management.
principles, environmental labelling, environmental performance evaluation and life cycle assessment.

**MTD315 COMPUTER INTERACTIVE GRAPHICS**

This course provides a basic background on geometry and computer graphics for virtual reality systems.

**MTD317 VIRTUAL REALITY SYSTEMS**

This introductory course covers the principles of virtual reality and its application in multimedia.