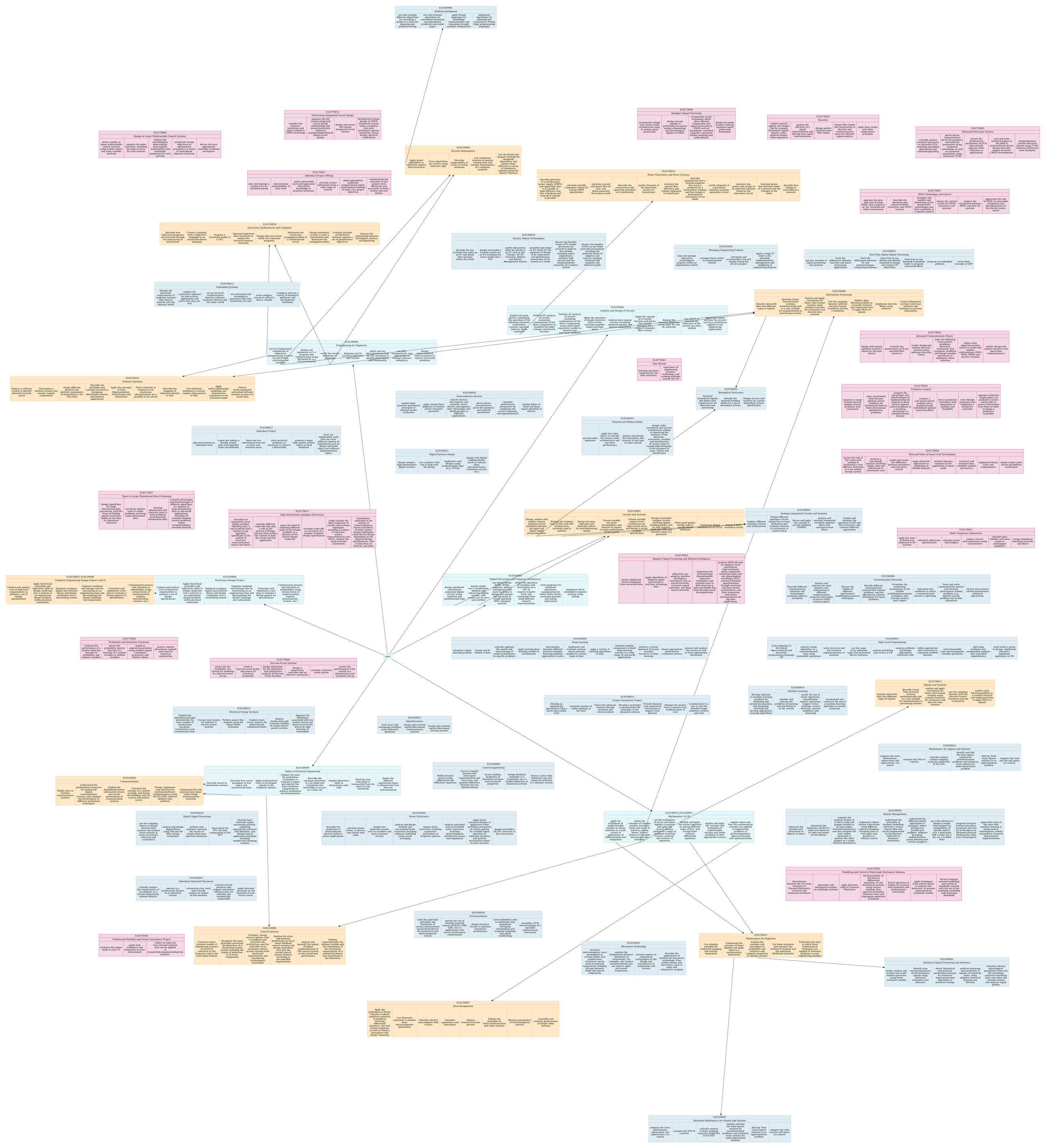
ELEC60004
Artificial Intelligence
use and evaluate different algorithms for searching a graph as a basis for planning and problem-solving
use and evaluate algorithms for automated reasoning in propositional, predicate and modal logics
apply formal knowledge for knowledge representation and reasoning through symbolic computation
implement algorithms for planning and reasoning in Prolog (logic programming language)
ELEC70012
Full-Custom Integrated Circuit Design
consider key features, limitations and topics related to CMOS technology
appreise the full custom integrated circuit design methodology and implementation skills related to analogue/digital/mixed signal circuit design
design and assess full custom integrated circuit layouts
develop full custom design of CMOS integrated circuits using a complete CAD tool (schematic capture, simulation, layout design, physical verification)
ELEC70006
Design of Linear Multivariable Control Systems
derive models of linear multivariable control systems using transfer matrix and state variable methods
compute the poles and zeros, including the type of zeros, for such systems
analyse the controllable, observability, detectability, stabilizability and minimality properties for such systems
synthesize design objectives as optimisation procedures in terms of norm-based objective functions
devise the most appropriate controller synthesis techniques
ELEC50006
Discrete Mathematics
Apply graph algorithms to efficiently explore data-structures
Prove algorithms are correct using inductive logic
Describe computability in terms of turing machines
Use complexity notation to analyse running time and storage requirements of algorithm or program
Use the divide and conquer strategy for designing algorithms, and analyse their efficiency in terms of complexity notation using the Master Theorem
ELEC70017
Individual Project (MEng)
plan and manage a project over an extended period
take personal responsibility of your work
tackle open-ended work and apply prior theoretical knowledge to practical situations
critically review information from a wide range of sources
adopt appropriate analytical, computational and/or experimental methods to meet your project objectives
communicate the outcomes of the project work effectively and accurately in both a written and oral format
ELEC50012
Power Electronics and Power Systems
describe operation of a switch-mode power supply (SMPS) and appreciate why it is capable of high efficiency and how step-down and step-up voltage is possible
calculate suitable component values for a given SMPS specification
calculate current and power flow for star- and delta-connected three-phase loads
describe the construction and operating principles of a transformer
justify elements of the equivalent circuit of a transformer
calculate the current flow, efficiency and voltage regulation in transformer
describe qualitatively how a rotating magnetic flux wave is produced in three-phase windings and how torque is developed by interaction of two fields
justify elements of a per-phase induction machine equivalent circuit
calculate slip, power and torque of an induction machine based on the equivalent circuit
calculate power flow between nodes of a network and the voltages at the nodes
describe how voltage is controlled in a network
ELEC70004
Analogue Signal Processing
recommend voltage and current mode architectures used in analog signal processing
design circuits capable of performing low power analog computation and processing of signals in CMOS
recommend circuit techniques which allow efficient computation and signal processing in the log-domain, switched capacitor correlated double sampling and spike domain
design mix-mode systems utilising analogue signal processing techniques
ELEC70039
Wavelets
analyse natural signals and images using wavelets, including biomedical signals, speech, audio, medical images, video sequences
analyse the efficacity of a signal representation and develop new signal representations
design perfect reconstruction filter banks
design filter banks and construction of discrete and continuous-time bases for efficient signal analysis
apply basic image and video compression principles
ELEC70003
Advanced Electronic Devices
critically analyse transport processes in modern devices (FETs), including tunnelling phenomena and self-heating/cooling
derive device characteristics given the geometry and material parameters using analytical estimations as well as numerical simulations using Sentaurus TCAD
extract the performance parameters of FETs and critically appraise their applications in applications
read and write technical papers in the field of semiconductor device design and their impact on future CMOS developments
design/optimise current and novel devices using TCAD software (Sentaurus from Synopsis)
ELEC50010
Instruction Architectures and Compilers
Describe how high-level programs are executed through the sequencing of instructions
Create a compiler from a high-level language to an instruction-based language
Program a functional model of a CPU
Optimize high-level descriptions to exploit the low-level memory hierarchy
Design data-structures which can represent programs
Determine the worst-case propagation delay of a combinational circuit
Design arithmetic circuits to meet a specification and determine the propagation delay
Evaluate possible architectural solutions against a set of performance objectives
Discuss the relationship between throughput, latency, and pipelining
ELEC60033
Electric Vehicle Technologies
describe the key systems that make up an EV and detail their function within the whole
design and model a traction system for an EV including the motor model and a FOC
model and analyse other key blocks in an EV such as the: Charger, DC-DC Converter, Battery and Battery Management System
assemble and adapt an EV model for the purposes of design of its subsystems and performance assessment of the system as a whole
discuss the broader range of EV design processes not covered in depth in this module including safety implications, charging of devices and the communications networks of a modern vehicle
discuss the impacts of EVs on the wider grid and environment including the potential future of vehicle-to-grid (V2G) and energy-charging (Demand-side response and Vehicle-to-grid)
ELEC60020
Managing Engineering Projects
lead and manage innovative technological projects within an engineering context
manage teams within an organisational context
anticipate and accommodate risk and change during the life of a project
apply a range of tools to the planning, implementation, management and budgeting of engineering projects
ELEC60025
Real-Time Digital Signal Processing
put the concepts of signal processing into practice
learn the differences between real-time and batch processing applications
learn the differences between SP and general-purpose computing hardware
learn how to use Matlab and Matlab Simulink to design and analyse SP algorithms
learn how to use Simulink Embedded Coder to program microcontrollers
program an embedded platform
revise basic concepts of DSP
ELEC60013
Embedded Systems
identify the functional requirements of computer systems that interact directly with the physical world
analyse the constraints imposed by time-critical applications and prove that they are met
set up low-level communication between software, hardware devices and the wider world
use interrupts and threading to guarantee that time constraints are met
write complex, low-level software that is reliable
configure and use a variety of hardware platforms and development toolchains
ELEC60004
Programming for Engineers
use the fundamental components of imperative programming to solve problems in C++ using structures and variables
design and implement a C++ program that communicates using file-based IO in a C++ environment
verify the correct behaviour of programs
diagnose and fix incorrect behaviour and crashes
select and use data-structures from the STL according to needed performance and functionality
use APIs, encapsulation, and abstraction to manage software complexity
design object-oriented data-structures to capture real-world problems
ELEC60002
Analysis and Design of Circuits
Explain the basic physics underlying the operation of the following electronic components: resistor, capacitor, inductor, diode, transistor
Perform DC analysis of circuits containing combinations of the above components to establish the nodal voltages and branch currents
Perform AC analysis of circuits containing combinations of the above components using small-signal equivalent models to linearise any non-linear elements
Apply the operation of simple transistor level circuits including amplifier stages and logic gates
Analyse basic opamp circuits containing idealised opamps and passive components
Apply the concept of a transfer function to derive the transfer functions for a range of standard filter circuits
Analyse the element behaviour of 1st order RC and RL networks
Use SPICE simulation to verify the behaviour of the circuits you have studied
Appreciate where and how the circuits you have studied are applied in real engineering applications
ELEC50009
Information Processing
Classify real-world data into different types of signals
Describe Linear Time-Invariant systems mathematically and in a way suitable for implementation in processing systems
Explain and apply convolution for linear time-variant systems using transfer functions for continuous and discrete time systems
Use the sampling theorem with the discrete Fourier Transform and the z-transform
Model a data filtering problem as a transfer function and understand how to apply filters to signals
Implement discrete filters using software
Create information systems which use software and hardware to process information
ELEC70045
Advanced Communication Theory
design and analyse optimum receivers based on 'decision theory'
evaluate the performance of M-ary matched filter receivers
model, design and analyse diversity systems using optimum diversity theory
solve the following three generic problems: 'detection', 'estimation' and 'reception' problems and design suitable processors to implement these solutions
utilise array signal processing theory to model and analyse multi-antenna SIMO, MISO, MIMO and massive systems
model, design and analyse mmwave and space-time communications.
ELEC70041
Year Abroad
learning outcomes supported by the host university
experience of engineering practice, technology, and working methods outside the UK
ELEC60005
Biomedical Electronics
Interpret biomedical signals and define their requirements for detection and processing
Identify the required building blocks for a given biomedical system
Design circuits and systems for a given biomedical system specification
ELEC70028
Predictive Control
construct a range of finite horizon optimal control problems with constraints
solve constrained finite horizon optimal control problems by formulating them as finite dimensional optimization problems
compare the advantages and disadvantages of implementing the solution to finite horizon optimal control problems as a receding-, decreasing- or variable-horizon fashion
transfer a real-world control problem into a mathematically well-defined optimal control problem
devise predictive controllers with guarantees of stability and feasibility
write Matlab programs that implement a predictive controller
appraise relatively simple papers on predictive control and be able to extract information from such a paper to design a predictive controller
ELEC70044
Role and Value of Smart Grid Technologies
assess the role of the smart grid concept in facilitating a cost effective transition to a low carbon energy system
perform a cost-benefit analysis, including supply risks and operational or investment costs
model and assess the difference between preventive and corrective control
apply advanced analytics for scheduling of flexible demand
perform big data analytics for the application of smart grids
construct and evaluate basic reliability models and metrics
implement Monte Carlo risk computations
model a basic cyber attack and defence mechanism
ELEC50014
Software Systems
Analyse a software system to identify potential security issues
Decompose a software system into loosely coupled components
Assign different physical and abstract components of networking to the OSI stack
Describe the principles and concepts involved in designing distributed systems and Internet applications
Apply the concepts of Data Representation, Presentation and Interaction
Think creatively in response to an awareness of/requirement for a problem to be solved
Describe the mapping of relational calculus to SQL
Use relational databases to answer complex data queries in SQL
Apply entity-relationship modelling and demonstrate translation to the relational model
Deliver multi-component networked software systems as part of a small team
ELEC60026
Semiconductor Devices
explain basic quantum mechanical principles of charged carrier conduction
apply energy band diagrams to analyse carrier transport processes
classify devices into majority and minority carrier devices and appreciate their advantages and disadvantages in different applications
derive device characteristics given the geometry and material parameters
calculate performance specifications by employing the correct equations and approximations
explain delays in small and large signal operation of devices
ELEC60031
Classical and Modern Radar
use the radar equations
apply the radar theory to classify the various radar architectures and evaluate their performance
analyse and design the transmitter and receiver of any type of radar system
design radar waveforms and system architectures aiming at improving the resolution in the detection, estimation, tracking and classification of various types of targets/environments in the presence of noise, clutter and interference
ELEC60011
Digital Systems Design
design complex, high performance digital systems
use a modern CAD tool to help with the design
implement such designs on programmable logic (e.g. FPGAs)
design with digital building blocks (such as memory chips, microprocessors, arithmetic circuits etc.)
ELEC70017
Individual Project
plan and execute an individual work
create and update a flexible project plan with specified tasks and fallbacks
learn and use information from one or more new technical areas
solve technical problems as necessary to achieve a deliverable
produce a major high quality written report to fixed deadlines
carry our independent work that can cover different aspects of engineering such as theoretical, practical, topics and software implementation topics
ELEC50001
Circuits and Systems
Design, analyse and explain sensors analogue circuit interfaces, stability in the input and digital signal processing phase
Explain the common type of DAC and ADC arrangements currently used in industry
Design low-pass, high-pass and band-pass filters for preconditioning signals
Choose suitable low-noise pre-amplifiers and analyse its impact on noise performance of the system
Design reasonably complex circuits involving digital building blocks such as shift register, RAM and ROM, and interface them to a processor
Write good quality Verilog code to specify digital hardware
Implement digital hardware on an FPGA
Design a basic testbench circuit
ELEC60003
Analogue Integrated Circuits and Systems
Analyse different analogue circuits and architectures
Design different analogue circuits taking into account limitations and imperfections due to circuitment or resolve these
Derive and apply the concept of current feedback OPAMPs
Analyse and calculate integrated switched capacitor filters and continuous-time filters
Explain and simulate the operation of A/D and D/A Converters and contrast different approaches
ELEC70047
HVDC Technology and Control
appraise the pros and cons of using HVDC with respect to HVAC for overhead line or cable transmission
describe the operation and control of HVDC converter systems and HVDC systems
recognise the benefits and limitations of two broad HVDC converter types and their suitability in a specific context
design the control system for HVDC converters and systems
analyse the interaction between HVDC and host AC systems
appreciate the role of HVDC in renewable integration and decarbonisation of the electric power sector
ELEC70007
Radio Frequency Subsystems
apply the main architectures employed in RF systems
interpret subsystem specifications
calculate power link budgets
analyse circuits and subsystems using S-parameters
calculate gain, stability and noise issues in small-signal amplifiers
design impedance matching networks and filters
ELEC50003_ELEC50008
Computer Engineering Design Project 1 and II
Capture and analyse a set of high-level requirements to produce a set of design specifications
Apply theoretical principles and laboratory skills to design, build and test a solution to an engineering design problem, within practical constraints
Organise workload and manage time by functioning as an engineering team and decomposing the design challenge into subsystems
Integrate analogue, digital and software theory and design techniques into a functioning system
Formulate and implement a test plan to evaluate a design against its specifications
Communicate process and outcomes to stakeholders using various forms of communication (reports, presentations, reviews, etc.)
ELEC60006
Electronics Design Project
Capture and analyse a set of high-level requirements to produce a set of design specifications
Apply theoretical principles and laboratory skills to design, build and test a solution to an engineering design problem, within practical constraints
Integrate analogue, digital and software theory and design techniques into a functioning system
Organise workload and manage time by functioning as an engineering team and decomposing the design challenge into subsystems
Formulate and implement a test plan to evaluate a design against its specifications
Communicate process and outcomes to stakeholders using various forms of communication (reports, presentations, reviews, etc.)
ELEC60001
Digital Electronics and Computer Architecture
design significant synchronous sequential digital systems using registers and combinational logic
design simple two's complement addition and subtraction digital circuits, with correct use of carry and overflow
use digital blocks: RAMs, ROMs, registers, adders, multiplexers, and state machines to implement the function and operation of simple pipelined RISC computer systems
model the operation of machine code instructions on a CPU at register-transfer level (RTL) and manipulate data using different numeric representations
write programs for arithmetic operations, manipulating bit arrays, using loops, accessing memory, and calling subroutines
implement I/O in embedded computer systems using polling
ELEC70001
Adaptive Signal Processing and Machine Intelligence
extract adaptively latent component from real-world data
apply algorithms of adaptive signal processing to real-time streaming data
effectively use adaptive machine intelligence techniques such as deep learning using recurrent neural networks, and deep neural networks
implement the corresponding dimensionality reduction techniques, and appreciate how to find structure in data and handle Big Data through tensor decompositions
produce MATLAB code for adaptive noise cancellation, high-resolution spectral estimation, beamformer estimation from your own physiological recordings (ECG), universal function approximation through recurrent and deep neural architectures, and their connection to tensor decompositions for big data applications.
ELEC60006
Communication Networks
Describe different communication networks and technologies including industry standards
Analyse and contrast the main features and relationship of different communication networks and quality of service (QoS) related aspects
Discuss the operation and performance of different performance models/assessment techniques
Identify different communication network QoS related problems, and the appropriate solution techniques for these problem
Formulate the underlying assumptions of the studied models/assessment techniques and critically analyse their impact
Determine the conditions in which a communication system is operating
State and solve communication system performance related problems (e.g. optimal routing problem and system utilisation)
Derive and evaluate related performance analytical expressions.
ELEC70048
Probability and Stochastic Processes
evaluate the performance of a system using key concepts of probability and random variables
derive the probability density function of a function of a random variable or random variables
model an engineering problem using random signals ('stochastic processes') and Markov chains
analyse random phenomena (signals and noise) in electrical engineering
ELEC70009
Discrete-Event Systems
assess the the suitability of a system for modeling in a discrete event set-up
create a discrete-event model and assess its important properties
design algorithms for the qualitative and quantitative analysis of Discrete Event Systems
design a supervisory controller and an observer automation
simulate a discrete event system
assess the performance of the system in a deterministic and stochastic set-up
ELEC60009
Deep Learning
formalise a deep learning problem
choose and fit models to data
critically appraise the merits and demerits of standard model architectures on specific problems
apply existing deep learning models to real datasets
discriminate between different deep learning problems/approaches to problems to solve
implement and evaluate common deep learning models for various types of data
apply a variety of learning algorithms to data
combine modular components to build deep learning systems in a wide range of real-world applications
perform a critical appraisal of recent scientific literature in deep learning
choose appropriate performance evaluation metrics
present and analyse the results as well as draw appropriate conclusions
ELEC60015
High Level Programming
write programs in the hybrid object-oriented and functional programming language F#
express simple algorithms in a transformation-oriented style using immutable operations
write recursive and tail recursive implementations of iteration
use list, map, array collection types and associated library functions
analyse and debug type errors in F#
analyse problems and design appropriate functional code
define appropriate data structures to represent problem domains
write immutable code and encapsulate mutable operations
split large problems into independently testable code with controlled dependencies
work within a group to design, implement and test a significant application in F#
ELEC60014
Group Consultancy Project
Develop an engineering specification from a given open-ended brief
Generate number of viable solutions to the brief
Select the optimum solution through technical and critical analysis
Develop a prototype to demonstrate the principles of the proposed solution
Provide financial and commercial information to support their decision
Manage the project from a resource and workload point of view
Communicate in a way to suit the intended target audience (written and oral)
ELEC60019
Machine Learning
develop solutions to machine learning problems by modelling and pre-processing data, and designing, selecting and develop appropriate learning algorithms
consider and contrast the problems of learning and overfitting in an ML system
justify the use of linear regression, classification, logistic regression, support vector machines, neural networks, nearest neighbour and clustering
recommend and construct the use of a machine learning algorithm in unseen situations
ELEC50013
Signals and Systems
classify real-world data into different types of signals
describe Linear Time-Invariant systems mathematically and in a way suitable for implementation in processing systems
explain and apply convolution for linear time-variant systems using transfer functions for continuous and discrete time systems
use the sampling theorem with the discrete Fourier Transform and the z-transform
model a data filtering problem as a transfer function and understand how to apply filters to signals
ELEC60021
Mathematics for Signals and Systems
compute the trace, determinant, eigenvalues and eigenvectors of a matrix
compute the SVD of a matrix
critically analyse a linearly varying system using the properties of the SVD
identify and find the least-square solution for over-determined problems and minimum norm solution for under-determined problem
find the Total Least Square solution to an approximation problem
compute the rank and the null space of a matrix
ELEC50002
Communications
Model noise in wireless communication systems
Understand the performance measures for analog and digital communication systems, and compare different analog and different modulation techniques
Explain the fundamental limits information theory sets on the performance of communication systems
Calculate the entropy of a random variable, and design the Huffman code for a given information source
Design, implement and characterise hardware/software implementation using the NI USRP software defined radio platform
Understand the role physical layer plays within larger communication networks
ELEC60008
Control Engineering
Model dynamic system using differential and difference equations
Given a transfer function find state-space representation and vice versa, and quantify difference between the two representations
Access stability properties of dynamical systems and structural properties
Design feedback controllers using systematic techniques to modify behaviour of dynamical systems
Assess a prior what behaviour can and cannot be achieved in a dynamic system
ELEC60023
Optoelectronics
solve wave and waveguide problems using Maxwell's equations
design and evaluate optical fibre-based communication systems
design and evaluate optical fibre-based sensing systems
ELEC60009
Topics in Electrical Engineering
Describe waves as information carriers
Describe how waves propagate in free space and transmission lines
Apply mathematical tools to investigate signals in the frequency domain
Explain the need for modulation techniques to achieve frequency shift and identify the basic hardware components to achieve modulation and demodulation
Describe the transport processes in a pn diode and extrapolate this knowledge to its use as a solar cell
Employ laboratory skills to characterise solar cells
Illustrate how solar polar is transported from the source to the household
Relate the different engineering topics to demonstrate how they are interconnected
ELEC60010
Digital Signal Processing
use the sampling theorem to design discrete data systems and analyse these systems in the discrete time domain and z-transform
analyse and design digital filters using FIR and IIR filter design techniques
perform and interpret correctly the results of simple short-time spectral estimation
learn about the FFT, the fast computation of the DFT
develop basic multirate signal processing systems, exploiting appropriate requirements and identities, and design typical application examples including sample-rate-changing systems
ELEC60024
Power Electronics
describe the properties of semiconductor devices useful in power applications
calculate power losses, in devices and choose heat sinks
design loss reduction circuits such as snubbers and quasi resonant circuits
analyse and design isolated and non-isolated dcdc converters including s-domain modelling using circuit averaging
analyse dcdc converters including qualitative assessment of frequency spectra
analyse controlled and uncontrolled acdc converters including electromagnetic interference issues and regulations
apply power converter designs to application areas including assessment of suitability for variable speed operation of induction machines and general purpose motor controls on drive systems
design and build a DC/DC converter in the coursework
ELEC60016
Individual Industrial Placement
critically analyse the requirements of a role and how it fits in an certain engineering related industry
operate in a professional manner in an industrial setting
summarise your work and critically analyse its impact on the business
criticise current practices and suggest alternative solutions that are ethically and economically responsible
make informed decisions on the direction of your future career
ELEC60018
Instrumentation
state the operation principles and limitations of various measurement sensors/transducers for mechanical and electromagnetic stimuli
specify the use of recently invested sensors (SQUID, GMR, QHE, etc) in applications with severe performance requirements
design interface circuits to optimise transducer performance
write embedded code to implement data acquisition (sampling, subsampling and irregular sampling) and signal conditioning
assemble a PCB level prototype of a specified measurement instrument
ELEC70030
Professional Portfolio and Group Consultancy Project
evidence the claims made in your CV
speak with confidence and eloquently on your achievement
reflect on what you have learned and how that can be applied in research/development/industrial practice.
ELEC60004
Control Systems
Construct linear dynamic models of engineering systems in terms of relevance in the frequency and in the state-space domain
Recognise the basic principles governing the behaviour of a closed-loop control system including the modes of behaviour of its basic components
Evaluate, among several options, how to configure and structure the architecture and the controller of an interconnected system starting from functional requirements and considering technological constraints
Analyse the static and dynamic performance of basic feedback control systems and design controllers such that the overall control system performs according to pre-specified requirements
Analyse and quantify the impact of digital implementation of the control system on the closed-loop performance
Validate experimentally the dynamic models and the satisfaction of the performance requirements on a selected hardware test benchmark in the laboratory
ELEC50007
Electromagnetism
Apply the techniques of Vector Calculus i.e. obtain analytical solutions to problems involving differential operators, line and surface integrals, as well as Green's, Divergence and Stokes' theorems
Use Maxwell's equations to explain basic electromagnetic phenomena
Calculate electric and magnetic field vectors
Calculate capacitance and inductance
Analyse transmission-line devices
Explain the principles of radio-communication and radar systems
Measure parameters of electromagnetic devices
Assemble and evaluate performance of simple radar systems
ELEC60022
Microwave Technology
interpret electromagnetic wave propagation in various media, how guided-wave structures can be used as practical components, bridging the gap between Radio and optical frequencies
analyse the fundamental physical limitations of components. For example, why surface mounted devices are not used in the upper microwave frequencies
present aspects of commercial technologies in the design and manufacture of components and circuits
describe the applications of commercial microwave technologies such as mobile phones and microwave ovens to radar and radiometric imaging
ELEC60030
Robotic Manipulation
represent the position and orientation of objects in space
determine the kinematic model of a robot arm based on its links and points of articulation
compute the position of pose of a robot's body and gripper based on joint angles (Forward Kinematics) and also compute the joint angles necessary to position the robot gripper in space (Inverse Kinematics)
implement robotic motion trajectories using different interpolation techniques, including joint vs. task space and position vs. velocity control
understand the principles of dynamic modelling and control (torque vs. position) but may not be implemented on the physical robot due to hardware limitations)
understand the different robotic approaches to grasping / object picking (e.g. parallel jaw grippers, adaptive grippers, underactuation, grasp planning and vacuum grippers)
use CAD software to design a simple robot gripper for manipulation of specific objects (e.g. a ping-pong ball, a golf ball, a toy car, a 6-sided dice)
program low-level motion controllers to execute and test all of the above on lab-based physical manipulators with arms and grippers
appreciate some of the ways that machine learning is revolutionising contemporary robotic manipulator research and practical implementation
ELEC70022
Modelling and Control of Multi-body Mechanical Systems
discriminate between the two main approaches in Classical Mechanics: vectorial and analytical mechanics
generalize real mechanical systems as multibody systems
apply the basic tools of Classical Mechanics
develop models, in the form of equations, of real mechanical systems using various methods from classical mechanics (Newton's laws and Lagrangian equations of motion)
derive equations of motion for systems with holonomic and nonholonomic constraints
apply techniques from control theory to control the behaviour of systems represented by multibody models
devise computer assisted modelling and control of multibody systems with the use of the multibody modelling code Simscape Multibody
ELEC60001
Advanced Mathematics for Signals and Systems
compute the trace, determinant, eigenvalues and eigenvectors of a matrix
compute the SVD of a matrix
critically analyse a linearly varying system using the properties of the SVD
identify and find the least-square solution for over-determined problems and minimum norm solution for under-determined problem
find the Total Least Square solution to an approximation problem
compute the rank and the null space of a matrix
ELEC60002
Statistical Signal Processing and Inference
model, analyse and predict real world random processes using linear stochastic models
identify time varying parameters of non-stationary signals using statistical estimation and inference
derive theoretical and practical performance bounds for statistical signal processing algorithms in practical settings
perform denoising and prediction of signals corrupted by noise, using adaptive statistical learning and filtering
estimate relevant physiological parameters from real life recordings acquired recordings (tremor, pulse rate) and critically analyse and improve signal quality
ELEC50011
Mathematics for Engineers
Use complex variables for contour mapping and contour integration
Understand the concepts of linear algebra and apply them in a mathematical framework
Explain the concepts and techniques of probability and statistics and compute properties of random systems
Use basic estimator and calculate the mean and variance of the maximum likelihood estimator
Formulate the ways in which these mathematical techniques are applied to technical problems in your engineering modules
ELEC40010_ELEC40011
Mathematics 1A 1B
apply the techniques of single-variable calculus to obtain solutions to a wide variety of applications of differentiation and integration
utilize the concepts of complex number, functions, limits and series to perform, among others, Fourier Analysis of periodic and non-periodic functions
use the techniques of vector and linear algebra to analyse and apply the solution methods to a range of problems involving vectors, matrices and systems of equations
identify and apply the correct approach to solving different types of second-order ordinary differential equations
explain and apply the concepts and techniques of multivariables calculus and tackle problems in vector appropriate context
explain where and how the mathematical concepts are applied to engineering problems in electromagnetism, signal processing and communications
ELEC60018
Instrumentation
state the operation principles and limitations of various measurement sensors/transducers for mechanical and electromagnetic stimuli
specify the use of recently invested sensors (SQUID, GMR, QHE, etc) in applications with severe performance requirements
design interface circuits to optimise transducer performance
write embedded code to implement data acquisition (sampling, subsampling and irregular sampling) and signal conditioning
assemble a PCB level prototype of a specified measurement instrument