



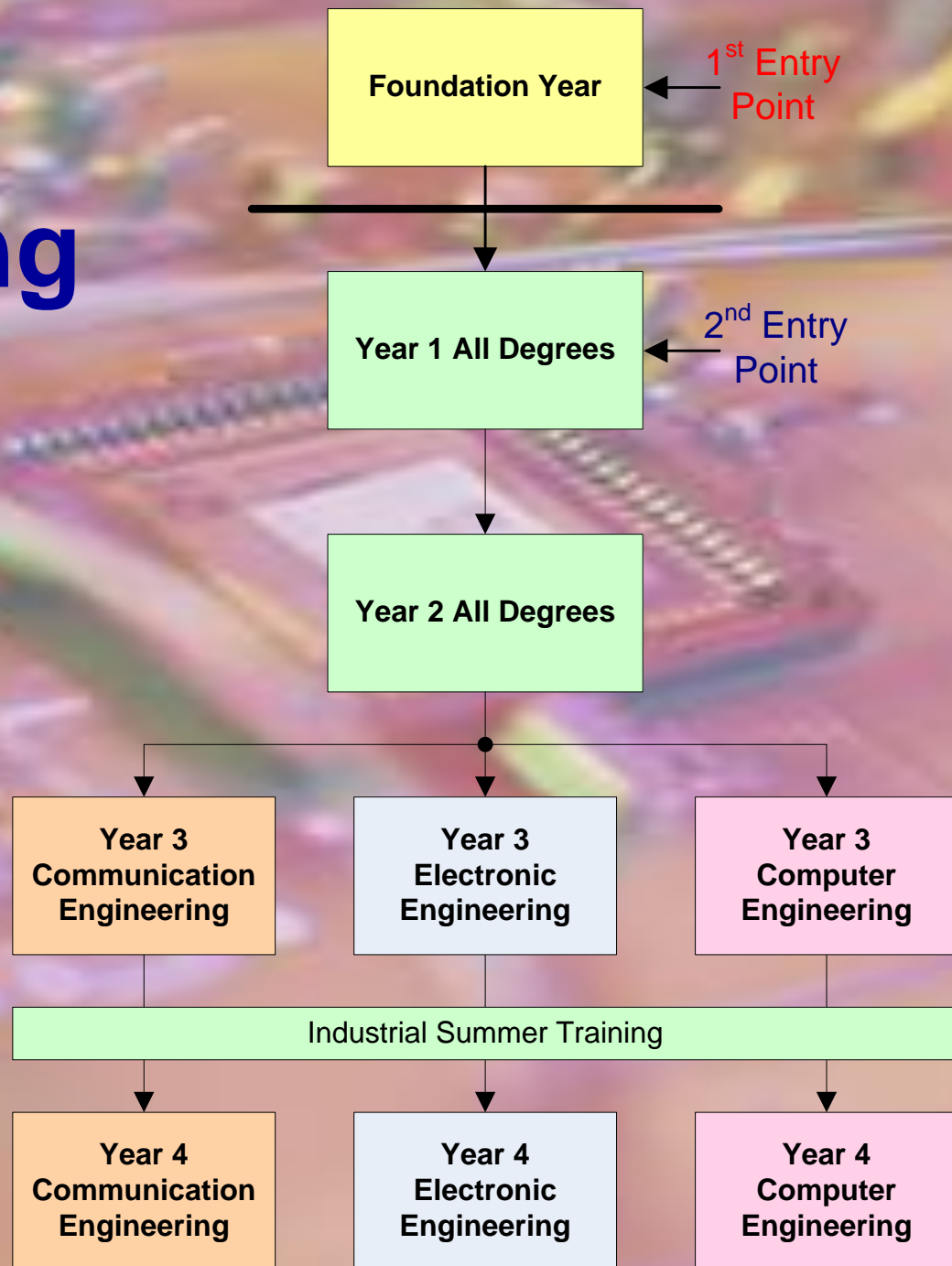
Selected Electronic Engineering Courses at KUSTAR

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Khalifa University of Science, Technology &
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Sharjah Campus

KUSTAR Engineering Programs Structure



ELECTRONIC ENGINEERING COURSES

- **Semiconductor Devices**
- **Analogue Filters**
- **Microwave Circuits & Devices**
- **Microelectronics Circuits & Systems**
- **Computer Interfaces**
- **Digital Systems Design**

Course Title	Objectives	Key Topics
<p>Semiconductor Devices [E203]</p>	<ul style="list-style-type: none"> -Describe semiconductor materials and carrier transport. -Explain the structure and operation of many devices like pn diodes, BJTs, MOSFETs and JFETs. -Understand the importance and benefits of device modeling in respect to their operation in electronic circuits. -Understand the significance of parameters quoted in the manufacture's data sheets. 	<ul style="list-style-type: none"> ▪Review of semiconductor physics: intrinsic and extrinsic materials, doping process, energy bands and carrier transport. ▪Operation of pn junction, BJTs, MOSFETs and MESFETs: carrier transport phenomena, h-parameters, small signal modeling as well as highlighting of their main features. ▪Introduction to CMOS and BiCMOS technologies and circuits. Brief overview of charge transfer, microwave and photonic devices.

Course Title	Objectives	Key Topics
<p>Analogue Filters [E320]</p>	<ul style="list-style-type: none"> -Understand the principles for filters design. -Design passive filters using different types of approximations. -Understand the principles of transferring filters from one type to another. -Design active filters. -Design and simulate analogue filters using CAD packages. 	<ul style="list-style-type: none"> ▪Steps involved in the design of filters: specifications, normalization, approximation, transfer function, realization and denormalization. ▪Approximation of magnitude characteristics: Butterworth, Chebyshev and elliptic magnitude characteristics. ▪Transfer functions: Butterworth, Chebyshev and elliptic filters. ▪Frequency Transformation: lowpass to highpass, bandpass and bandreject transformations. ▪Synthesis of passive networks: filter transfer function by two-port networks, LC Ladders. ▪Synthesis of active networks: first-order amplifier filters, higher-order amplifier filters, overview of switched capacitor, surface-wave and microwave filters. ▪Designing filters using CAD packages.

Course Title	Objectives	Key Topics
<p>Microwave Circuits & Devices [E322]</p>	<ul style="list-style-type: none"> -Exhibit a good qualitative understanding of microwave components and practical structures most useful to an engineer. -Possess the kind of information required to understand and appreciate systems which employ microwave circuits. -Use his theoretical and practical knowledge in the design of microwave circuits. -Have sufficient knowledge to design microwave sub-systems based on commercially available microwave circuitry. -Appreciate some of the mechanical and electrical constraints of microwave circuitry. 	<ul style="list-style-type: none"> ▪Transmission lines: Two-wire lines, coaxial cable, waveguide, planar transmission lines. ▪Components: Connectors, attenuators, slotted line, cavity, dielectric resonator, terminations, couplers, T-junction, isolator, detector mounts, impedance transformers, converters. ▪Signal amplification: Klystron, travelling wave tube, transistors, microwave amplifier, noise considerations. ▪Devices: Microwave diodes, practical structures point contact, beam-lead, Schottky barrier, FETs, bipolar transistors. ▪Mixers: Mixer operation-single diode, singly balanced, doubly balanced, dual gate FETs, effect of local oscillator. ▪Measuring Techniques: Attenuation, swept techniques, standing waves, coupling coefficient.

Course Title	Objectives	Key Topics
<p>Microelectronic Circuits & Systems [E411]</p>	<ul style="list-style-type: none"> -Understand the modeling of CMOS devices. -Analyse and design basic CMOS building blocks. -Analyse and design CMOS amplifiers. -Design CMOS operational amplifiers from basic CMOS building blocks. -Understand the different types of data converters. 	<ul style="list-style-type: none"> ▪CMOS analogue circuit modeling: Simple MOS small & large signal models, second-order model effects. ▪CMOS device characterization: Geometrical aspects of characterization, characterization of the transistor and other circuit components. ▪Basic MOS building blocks: MOS active resistors and load devices, MOS switch, MOS capacitors, MOS amplifier, current mirrors, current & voltage references. ▪Two-stage CMOS amplifiers: DC voltage gain, frequency response, nulling, slew rate & settling time, input common-mode range and CMRR, practical considerations in op amp design. ▪High-performance op-amps: Cascode CMOS op amps, folded cascode op amps, low-noise op amps, high-frequency op amps. ▪Switched-Capacitor Circuits. Sigma-Delta data converters.

Course Title	Objectives	Key Topics
<p>Computer Interfaces [E412]</p>	<ul style="list-style-type: none"> -Understand the principles and practical issues in computer interfacing using serial and parallel interfacing standards. -Understand the principles and practical issues in interfacing analogue and digital signals to a microprocessor. -Select industry standard buses and interfaces for specific tasks. -Design and implement hardware and software for basic interfacing tasks. 	<ul style="list-style-type: none"> ▪Digital data communication standards - Serial communications: Devices, RS232 and RS422 protocols, handshaking signals, implementing an RS232 communications link on IBM PC. ▪Universal Serial Bus: USB standards. Types and elements of USB Transfers. Development procedure of USB application. ▪Parallel communications: The General Purpose Interface Bus (GPIB), GPIB signals and lines, handshaking and interface management. Implementing a GPIB link with IBM PC. ▪Digital and Analogue Interfacing - Digital Interfacing: Digital I/O ports, Interfacing external signals to digital I/O ports, optical isolation. ▪Analogue Interfacing: Revision of A/D and D/A conversion techniques, multiplexing, analogue I/O cards, data acquisition and control using the IBM-PC.

Course Title	Objectives	Key Topics
<p>Digital Systems Design [E422]</p>	<ul style="list-style-type: none"> -Represent digital systems using Moore and Mealy models. -Design and implement synchronous circuits using both Moore & Mealy approaches and assess their timing implications. -Use design procedures to synthesize asynchronous digital circuits. -Understand the race and hazard conditions in asynchronous circuits and how to overcome them. -Understand the architecture of the various FPGA devices. -Understand digital systems synthesis and the design flow using HDLs. -Synthesis combinational and sequential systems using Verilog. -Compare the main features of the major hardware description languages. -Understand the bussing strategies used in the implementation of a digital system. -Compare the various approaches used to implement the controller of a digital system. 	<ul style="list-style-type: none"> ▪Digital System Design: Revision of design techniques for sequential systems, state machine structures (Moore & Mealy), algorithmic state machine (ASM) design methodology. ▪Asynchronous Sequential Machines: General procedure for the design of asynchronous sequential machines. Race and hazard conditions in asynchronous sequential designs. ▪Field Programmable Gate Arrays (FPGAs): Alternative FPGA architectures, programming and configuring an FPGA, FPGA verses ASIC design styles. ▪Synthesis and HDL: Introduction to digital systems synthesis, overview of HDL (hardware design languages), HDL based design flow. ▪Verilog: Verilog language concepts, modules and ports, Verilog operators and expressions, data flow level coding, behavioural level coding, finite state machines coding. ▪Other HDL Languages: Introduction to System Verilog, SystemC and VHDL. ▪Computer Organization: Structure of a computer, bussing strategies, finite state machines for simple CPUs, controller implementation using microprogramming.