Princess Sumaya University for Technology

The King Abdullah II School of Engineering

M.Sc. in Electrical Engineering Curriculum

Starting with the Academic Year 2019/2020

M.Sc. in Electrical Engineering Curriculum

Course Numbering System

D5	D4	D3	D2	D1

Where:

Digit	Description	Details
D2 D1	Serial Number	Within the area
D3	Level	
D4	Specialization	1. Electronics Engineering 2. Computer Engineering 3. Communications Engineering 4. Electrical Power & Energy Engineering
D5	Faculty	1. King Hussein Faculty for Computing & Information Sciences 2. King Abdullah II Faculty of Engineering 3. King Talal Faculty for Business & Technology

A Master's degree in Electrical Engineering (Thesis) at Princess Sumaya University for Technology requires the successful completion of 34 credit hours distributed as follows:

Department Requirements (25 Credit Hours)

a. Mandatory Courses (16 Credit Hours):

Course No.	Course Title	Credit Hours	Prerequisite
20701	Seminar & Research Methodology	1	—
21701	Advanced Electronics	3	—
22701	Embedded Systems Design	3	—
23702	Digital Communications	3	—
24705	Optimal Power Systems	3	—
31731	Engineering Analysis	3	—

b. Elective Courses (9 Credit Hours):

Course No.	Course Title	Credit Hours	Prerequisite
20719	Special Topics in Electrical Engineering (1)	3	**To be set by Dept.**
20720	Special Topics in Electrical Engineering (2)	3	**To be set by Dept.**
21702	VLSI Design	3	—
21703	Communication Circuits and Systems	3	—
21704	Optoelectronics	3	—
22702	Real-Time Computing	3	—
22703	Advanced Computer Architecture	3	—
22704	Advanced Computer Networks	3	—
22705	Algorithms and Architectures	3	—
23701	Stochastic Processes	3	—
23703	Wireless and Mobile Communications	3	23702
23704	Advanced DSP	3	—
23705	Coding Theory	3	23702

23706	Optical Communication	3	—
24701	Advanced Power Electronics	3	—
24702	Distributed Generation	3	—
24703	Protection of Power Systems	3	—
24704	Digital Control	3	—

Thesis Requirements (9 Credit Hours):

Course No.	Course Title	Credit Hours	Prerequisite
20799	Thesis	9	*20701
207990	Thesis	0	—
207993	Thesis	3	—
207996	Thesis	6	—

Course Description Master's Electrical Engineering (Thesis)

20701 Seminar & Research Methodology
Prerequisite: None
Credit Hours: 1

This course aims at exposing students to the most current developments and trends in the field of electrical engineering. It also aims to improve students' presentation, communication, and writing skills. In addition, the seminar covers basic research methodologies to prepare students for their master's thesis, and provides them with a forum to represent their research work and offer critiques of others' work.

20719 Special Topics in Electrical Engineering (1)
Prerequisite: To be set by Dept.
Credit Hours: 3

The objective of this course is to introduce advanced and new topics in Electrical Engineering. The topics may change from one semester to another according to latest technological advances and available faculty specializations.

20720 Special Topics in Electrical Engineering (2)
Prerequisite: To be set by Dept.
Credit Hours: 3

The objective of this course is to introduce advanced and new topics in Electrical Engineering. The topics may change from one semester to another according to latest technological advances and available faculty specializations.

20799 Thesis
Prerequisite: Finish 15 Credit Hours
Co-requisite: 20701
Credit Hours: 9

After reviewing literature, the student defines a research problem under the supervision of a faculty member. Then he/she develops a suitable solution and writes the thesis, describing the targeted problem, his/her suggested solution and obtained results. Afterwards, the student defends his thesis against an appointed examining committee.

21701 Advanced Electronics
Prerequisite: None
Credit Hours: 3

Linear and non-linear operational amplifier circuits. Frequency response and compensation. A/D converters. CMOS logic design. Introduction to radio frequency logic circuits.

21702 VLSI Design
Prerequisite: None
Credit Hours: 3

This course covers all the major steps of the design process which includes: logic, circuit and layout design; a variety of computer aided tools are discussed and used in class; the main objective of this course is to provide VLSI design experience that includes the design of basic VLSI CMOS functional blocks, verification of the design, testing and debugging.

21703 Communication Circuits and Systems
Prerequisite: None
Credit Hours: 3

This course covers circuit- and system-level design issues of high speed communication systems with primary focus on wireless and broadband data link applications. Specific circuit topics include: transmission lines, high speed and low noise amplifiers, VCO's and high speed digital circuits. Specific system topics include: frequency synthesizers, clock and data recovery circuit and transceivers.

21704 Optoelectronics
Prerequisite: None
Credit Hours: 3

Technology of ultrafast diode LASERs, from the basic physical principles to applications in communications. Ultrafast optoelectronics and applications of semiconductor diode LASER arrays. Coherent and incoherent LASERs. Edge- and surface-emission. Horizontal- and vertical-cavity. Individually addressed, lattice- and strained-layer systems.

22701 Embedded Systems Design
Prerequisite: None
Credit Hours: 3

Microprocessor-Based Embedded Systems Design. Hardware and Software Design using 16-bit or higher MCUs. Embedded hardware and software components. Design requirements, constraints and standards. Conventional vs. Model-Based Design approaches. Embedded Software Design and programming using low-level and high-leval programming languages. Model-Based and autocode generation approaches for rapid prototyping. Advanced topics in embedded systems such as Real-time Operating Systems (RTOS), multi-tasking application software, main loop designs, inter-task communication, cooperative and priority pre-emptive designs, Controller Area Networks (CAN).

22702 Real-Time Computing
Prerequisite: None
Credit Hours: 3

Principles of real-time computing. Hard and soft real-time systems. Multitasking. Scheduling policy. Periodic and aperiodic task scheduling. Priority driven schedulers. Earliest deadline first algorithm. Adaptive partition scheduler. High performance systems. Reliability applications.

22703 Advanced Computer Architecture
Prerequisite: None
Credit Hours: 3

Review of computer design principles. Software and hardware to exploit instruction level parallelism (ILP). Limits on ILP-level parallelism, multiprocessors, multi-core processors and multi-threading. Cache coherence and memory consistency. Advanced memory hierarchy design. Advanced topics in storage systems. Designing and evaluating I/O systems.

22704 Advanced Computer Networks
Prerequisite: None
Credit Hours: 3

Overview of computer networks. Wireless and mobile networks. Multimedia networking. Security in computer networks. Network management. Network modeling and simulation.

22705 Algorithms and Architectures
Prerequisite: None
Credit Hours: 3

Design methodology including: algorithm representation pipeline and retiming, unfolding and folding. Systolic array. Bit-level and redundant arithmetic. Sub expression sharing. Synchronous and asynchronous waves. Synthesis and CAD.

23701 Stochastic Processes
Prerequisite: None
Credit Hours: 3

Review of probability theory and random variables. Mathematical description of random signals. Linear system response. Wiener, Kalman and other filters. Time averages and ergodicity. Systems response to random signals. Markov chains.

23702 Digital Communication
Prerequisite: None
Credit Hours: 3

Review of random processes and analytic signals. Digital modulation schemes and communications channels, optimum receivers for AWGN channels. Information theory and channel capacity. Multichannel and Multicarrier systems.

23703 Wireless and Mobile Communications
Prerequisite: 23702
Credit Hours: 3

Digital signaling over fading multipath channels. Spread spectrum signals for digital communications. Multiple access systems. Time-division multiple access. Code-division multiple access. Frequency-division multiple access. Diversity and MIMO systems.

23704 Advanced DSP
Prerequisite: None
Credit Hours: 3

Wiener filters. Linear prediction. Least Mean Square (LMS) adaptive filters. Normalized NLS adaptive filters. Recursive Least Square algorithms. Kalman filters. Implementing adaptive filters using MatLab.

23705 Coding Theory
Prerequisite: 23702
Credit Hours: 3

Coding techniques: Reed Salmon, Hamming, and convolution. Concatenated serial and parallel, hard and soft decision decoding methods. Turbo codes decoding. The maximum a posteriori algorithm (MAP). The soft output algorithms. Bit Error Rate evaluation (BER).

23706 Optical Communications
Prerequisite: None
Credit Hours: 3

Introduction to optical communications. Propagation of light in an optical fiber. Semiconductor loses for optical communications. Optical components: passive, WDM, optical filters, optical modulators and optical amplifiers. Analogue and digital coding. Signal to noise considerations. Optical systems and networks. System design.

24701 Advanced Power Electronics
Prerequisite: None
Credit Hours: 3

Electronic conversion and control of electrical power: semiconductor switching devices, power converter circuits and control of power converters. AC/AC, AC/DC, DC/DC and DC/AC power converters. Circuit simulation. Advances in batteries.

24702 Distributed Generation
Prerequisite: None
Credit Hours: 3

Steady state operation of Distributed Generation (DG): voltage rise, losses and reactive power control. Fixed and variable speed induction generators. Fault currents from DG. Fault current limiters and protection. Active distribution networks. Contribution of DG to system security.

24703 Protection of Power Systems
Prerequisite: None
Credit Hours: 3

Protection system components. Types of relays and circuit breakers. Protection of generation, bus bars, transformers and lines.

24704 Digital Control
Prerequisite: None
Credit Hours: 3

Discrete-time systems. Difference equations. Z-transform. Inverse Z-transform. Flow graphs. State variables. Transfer functions. Sampling and reconstruction of control systems. Zero-order and first-order hold. System time response characteristics. Stability analysis. Bi-linear transform. Jury's stability test. Pole assignment and state estimation. Controllability and observability. Ackerman's formula. Linear quadratic optimal control.

24705 Optimal Power Systems
Prerequisite: None
Credit Hours: 3

Economic Dispatch, Optimization Techniques, Unit Commitment, Review of AC and DC Power Flow, Optimal Power Flow, State Estimation in Power Systems, Contingency Analysis

31731 Engineering Analysis
Prerequisite: None
Credit Hours: 3

Power series solution of differential equations and special functions (Bessel's functions and the Fourier-Bessel Series). Solutions of partial differential equations, heat and wave equations and Laplace equation. Sturm-Liouville problems and orthogonal functions in orthogonal coordinate systems. Separation of variables. Fourier series and Fourier integral. Complex Integration.