Plan Number				2009

Study Plan
Masters of Science in Computer Engineering and Networks
(Thesis Track)

I. General Rules and Conditions

1. This plan conforms to the regulations of the general frame of programs of graduate studies at the University of Jordan.
2. Candidates for admission in this program are holders of the Bachelor's degree in the following specialties:
   a) Computer Engineering
   b) Electrical Engineering
   c) Networks Engineering
   d) Communications Engineering
   e) Electronics Engineering

II. The Study Plan: Studying (33) credit hours as follows:

1. Obligatory courses listed in Table 1; (15) Credit Hours.

Table 1: Obligatory Courses for Thesis Track Students

Course No.	Course Title	Credit hrs.	Pre-requisite
0903720	Random Variables and Stochastic Processes	3	-
0903723	Analysis of Communications Networks	3	0903720
0907721	Network Systems Design	3	-
0907731	Advanced Computer Architecture	3	-
0907741	Distributed Systems	3	0907721

2. Elective courses selected from the list shown in Table 2; (9) Credit Hours.

Table 2: Elective Courses for Thesis Track Students

Course No.	Course Title	Credit hrs.	Pre-requisite
0903721	Digital Communications I	3	-
0903725	Wireless Communication Systems	3	-
0903728	Data Communication Systems	3	-
0903730	Multimedia Streaming	3	-
0907702	Computer Performance Evaluation	3	-
0907722	Networks and Systems Security	3	0903720
0907723	Wireless Networks	3	0907721
0907732	Advanced Embedded Systems	3	-
0907733	Parallel Processors	3	-
0907779	Special Topics in Computer Engineering and Networks	3	-

3. Masters Thesis, 0907799; (9) Credit Hours.

Plan Number				2009

Study Plan
Masters of Science in Computer Engineering and Networks
(Non-Thesis Track)

I. General Rules and Conditions

1. This plan conforms to the regulations of the general frame of programs of graduate studies at the University of Jordan.
2. Candidates for admission in this program are holders of the Bachelor's degree in the following specialties:
   a) Computer Engineering
   b) Electrical Engineering
   c) Networks Engineering
   d) Communications Engineering
   e) Electronics Engineering

II. The Study Plan: Studying (33) credit hours as follows:

1. Obligatory courses listed in Table 3; (24) Credit Hours.

Table 3: Obligatory Courses for Non-Thesis Track Students

Course No.	Course Title	Credit hrs.	Pre-requisite
0903720	Random Variables and Stochastic Processes	3	-
0903723	Analysis of Communications Networks	3	0903720
0903725	Wireless Communication Systems	3	-
0907721	Network Systems Design	3	-
0907722	Networks and Systems Security	3	0903720
0907723	Wireless Networks	3	0907721
0907731	Advanced Computer Architecture	3	-
0907741	Distributed Systems	3	0907721

2. Elective courses selected from the list shown in Table 4; (9) Credit Hours.

Table 4: Elective Courses for Non-Thesis Track Students

Course No.	Course Title	Credit hrs.	Pre-requisite
0903721	Digital Communications I	3	-
0903728	Data Communication Systems	3	-
0903730	Multimedia Streaming	3	-
0907702	Computer Performance Evaluation	3	-
0907732	Advanced Embedded Systems	3	-
0907733	Parallel Processors	3	-
0907779	Special Topics in Computer Engineering and Networks	3	-

3. The Comprehensive Exam (0907798).

III. Course Descriptions

0903720 Random Variables and Stochastic Processes (3 Credit Hours)

Probability and random variables. Distribution and density functions. Functions of random variables. Two random variables and sequences of random variables. Multidimensional random variables. Stochastic Processes. Markov chains. Spectral representation of stochastic processes. Spectral estimation. Project.

0903721 Digital Communications I (3 Credit Hours)

Introduction to Communication Systems. Baseband and Bandpass digital modulation techniques: Line Codes, ASK, FSK, PSK, DPSK, QAM. Performance measures: power, bandwidth, bit error rate. Carrier and symbol synchronization. Signal design for band-limited channels. Signal design for fading channels. Project.

0903723 Analysis of communication Networks (3 Credit Hours)
Pre-requisite: 0903720

Introduction to queuing theory and traffic engineering. Markov chains, steady-state and balance equations. Continuous and discrete arrival models. Basic queuing systems. Erlang formulas. Applications to telephony systems and aata networks, performance parameters (blocking probability, delay, throughput and reliability). Systems with vacations, priority systems, polling and reservation systems. Network simulation. Project.

0903725 Wireless Communication Systems (3 Credit Hours)

Review of Multiple Access Techniques: TDMA, FDMA, CDMA, OFDMA. Design of wireless communication systems: modulation, propagation, channel estimation, equalization and coding. Cellular systems (GSM/3G/4G), Synchronous and Asynchronous CDMA and code synchronization. CDMA performance and multi-user interference cancellation. Satellite communication systems. Indoor communication systems, wireless LANs and wireless protocols.

0903728 Data Communication Systems (3 Credit Hours)

Introduction to communication and switching networks. Asynchronous and synchronous transmission, SDH/SONET. Design and planning of telephony systems. Broadband access technologies. Internetworking and the Internet Protocol (IP), routing in IP. Quality of Service (QOS). Voice over IP (VoIP). Audio and video streaming. IP network planning. Integration of data and cellular/wireless networks. Security issues. Project.

0903730 Multimedia Streaming (3 Credit Hours)

Information Measures. Audio Video Data Compression. Performance of Compression Techniques and Rate Distortion Function. Mathematical Introduction to Number Theory. Cyclic, BCH and CRC Codes. Convolutional and Turbo Codes. LDBC Codes. Performance of Error Correcting Codes. Packet Data Transmission and Formatting for Audio and Video Data.

0907702 Computer Performance Evaluation (3 Credit Hours)

Issues in Performance Evaluation and Benchmarking. Measurement Tools and techniques, Trace Driven and Execution Driven Simulation. Choice of metrics. Benchmarks. Statistical techniques for Performance Evaluation. Trace Generation and Validation, Synthetic Traces, Verification of Simulators. Design of Experiments. Analytical Modeling of Processors, Statistical modeling, Hybrid Techniques. Application of queuing theory, Markov models and probabilistic models for computer system evaluation. Workload Characterization.

0907721 Network Systems Design (3 Credit Hours)

This course gives a broad view of the current state of computer networking research. Topics include: Internet architecture; Internet routing: the Border Gateway Protocol (BGP), routing characterization, routing security, Internet AS relationships, traffic engineering, end host congestion control; quality-of-service, network security: intrusion detection systems, worms, and honeypots; mobile and wireless networking; peer to peer and overlay networking; content distribution networks; sensor networks; critical network infrastructure services: Domain Name Server (DNS), mail servers, etc.; network measurement: distance estimation, bandwidth measurement, trouble shooting tools; network management.

0907722 Networks and Systems Security (3 Credit Hours)
Pre-requisite: 0903720

Review of Computer Networks. Number Theory and Field Arithmetic. Sources of Network Threats. Data Encryption: Cryptography and Ciphering. Risk Management. Key Management. Protocols and Algorithms of Security Systems. Email and Web Security and Firewalls. Performance Evaluation of Security Systems.

0907723 Wireless Networks (3 Credit Hours)
Pre-requisite: 0907721
Introduction to wireless networks: physical layer, MAC and IEEE 802.11, HIPERLAN, Bluetooth, channel assignment and channel hopping, power control and rate control, multi-radio, network layer, mobile IP, and naming, routing in mobile networks, transport protocol in wireless networks; types of wireless networks: wireless mesh networks, sensor networks, cellular networks, delay tolerant networks, RFID and WiMax; wireless network management and security: localization, network usage studies, network diagnosis, network security.

0907731 Advanced Computer Architecture (3 Credit Hours)
Review of computer design principles, processor design, RISC processors, pipelining, and memory hierarchy. Instruction level parallelism (ILP), dynamic scheduling, multiple issue, speculative execution, and branch prediction. Limits on ILP and software approaches to exploit more ILP. VLIW and EPIC approaches. Thread-level parallelism, multiprocessors, chip multiprocessors, and multi-threading. Cache coherence and memory consistency. Advanced memory hierarchy design, cache and memory optimizations, and memory technologies. Advanced topics in storage systems. Designing and evaluating I/O systems.

0907732 Advanced Embedded Systems (3 Credit Hours)
System specifications. Requirements and models of computation including State Charts, SDL, Petri nets, Message Sequence Charts, UML. Process networks, Java, VHDL. SystemC, Verilog and System Verilog, and SpecC. Embedded system hardware, I/O, communications, processing units, memories. Embedded operating systems, middleware, and scheduling. Prediction of execution times. Scheduling in real-time systems. Embedded operating systems. Implementing embedded systems: hardware/software codesign. Task-level concurrency management. High-level optimizations. Hardware/software partitioning. Compilers for embedded systems. Voltage scaling and power management. Actual design flows and tools. Validation. Simulation. Rapid prototyping and emulation. Test. Fault simulation. Fault injection. Risk and dependability analysis. Formal verification.

0907733 Parallel Processors (3 Credit Hours)

In-depth study of the design, engineering, and evaluation of modern parallel computers. Fundamental design: naming, synchronization, latency, and bandwidth. Architectural evolution and technological driving forces. Parallel programming models, communication primitives, programming and compilation techniques, multiprogramming workloads and methodology for quantitative evaluation. Latency avoidance through replication in small-scale and large-scale shared memory designs; cache-coherency, protocols, directories, and memory consistency models. Message passing: protocols, storage management, and deadlock. Efficient network interface, protection, events, active messages, and coprocessors in large-scale designs. Latency tolerance through prefetching, multithreading, dynamic instruction scheduling, and software techniques. Network design: topology, packaging, k-ary n-cubes, performance under contention. Synchronization: global operations, mutual exclusion, and events. Alternative architectures: dataflow, SIMD, systolic arrays.

0907741 Distributed Systems (3 Credit Hours)

Pre-requisite: 0907721

Introduction to Distributed Systems. Distributed Operating Systems. Processes and Inter-process Communication (IPC). Distributed File Systems. Remote Procedure Calls (RPC). Security Models. Distributed Architectures and Technologies. Middleware. Object Based Distributed Systems. Messaging and Message Oriented Systems. Agent-Based Systems. Distributed Application Project.

0907779 Special Topics in Computer Eng. and Networks (3 Credit Hours)

Topics of special interest in current computer engineering and networks issues. The course description is specified by the department at every course offering.