مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

The University of Jordan

Accreditation & Quality Assurance Center

Curriculum for Master Degree

Program Name:

Electrical Engineering/Power

(Thesis Track)

1.	**School**	**Engineering**
2.	Department	**Electrical Engineering**
3.	Program title (Arabic)	ماجستير الهندسة الكهربائية/قوى
4.	Program title (English)	**Master in Electrical Engineering/Power**
5.	Track	**Thesis**

First: General Rules & Conditions:

Plan Number	specialization	Degree	Dep #	School #	Year	Track
	31	**8**	**03**	**09**	**2017**	**Thesis**

1. This plan conforms to the valid regulations of the programs of graduate studies.

2. Specialties of Admission:

- The First Priority: Bachelor in Electrical Engineering, Bachelor in Electrical Power Engineering

Second: Special Conditions: None.

Third: Study Plan: Studying (33) credit hours as following:

1. Obligatory Courses (15) credit hours:

Course No.	Course Title	Credit Hrs.	Theory	Practical.	Pre/Co-requisite
0903777	Research Methodology	3	3	-	-
0933741	Linear Systems	3	3	-	-
0923785	Advanced Power System Protection	3	3	-	-
0933786	Renewable Energy and Distributed Generation	3	3	-	-
0933789	Power System Operation and Economics	3	3	-	-

الجامعة الأردنية
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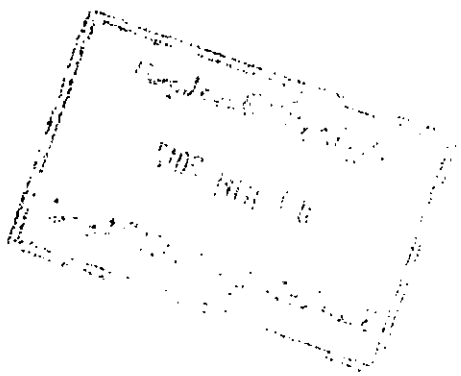
الخطة الدراسية المعتمدة



2. Elective Courses: Studying (9) credit hours from the following:

Course No.	Course Title	Credit Hrs.	Theory	Practical.	Pre/Co-requisite
0943701	Digital Signal Processing and Filtering	3	3	-	-
0923742	Advanced Control Systems	3	3	-	-
0923771	Electrical Machines and Drives	3	3	-	-
0903780	Smart Grids and Sustainable Electricity	3	3	-	-
0923781	High Voltage Engineering	3	3	-	-
0923782	Power System Planning and Reliability	3	3	-	-
0923783	Power System Stability and Control	3	3	-	-
0923784	Advanced Power Electronics	3	3	-	-
0943787	Power Distribution Systems	3	3	-	-
0923788	Power Systems Quality	3	3	-	-

3. Thesis: (9) Credit hours (0903799).

*notes

Course Description

0943701 Digital Signal Processing and Filtering (3 credits)
Review of discrete time signals and systems. Z-transform. Discrete and fast Fourier transform. FIR and IIR filter design. Multirate digital signal processing. Introduction to digital signal processing system design. Applications of digital signal processing.

0933741 Linear Systems (3 credits)
Linear spaces and operators. Mathematical description of systems. State-space description. Input/output description. Stability. Controllability, observability and observers. Some properties of rational matrices. Matrix functions, Identification and estimation. Composite systems. Feedback controllers. Minimal realization. Model matching.

0923742 Advanced Control Systems (3 credits)
Simulation methods: Matlab, Simulink and Labview. Review of linear conventional control. Nonlinear control systems with Layapunov stability. Introduction to optimal control. Decoupled control. Adaptive model reference control systems using variable Structure systems. Intelligent control methods: Fuzzy control, artificial neural networks, genetic algorithms, and variable structure systems. Hybrid intelligent control methods.

0923771 Electrical Machines and Drives (3 credits)
Electric machines review. Transient analysis of series-parallel circuits, numerical solution of differential equation using Matlab and Simulink. Induction to machines: steady state operation, dynamic model in stationary and rotating frames, D-Q model of three-phase induction machines. Synchronous machines: steady state operation, rotor angle, dynamic model in stationary and rotating frames, D-Q model of three-phase synchronous machines. Wind energy systems: wind turbine, wind power, speed and pitch control, induction generator, doubly-fed induction generator, brushless doubly-fed induction generator, permanent magnet generator. AC motor drives: introduction, induction motor drives, synchronous motor drives.

0903777 Research Methodology (3credits)

Writing, presentation, literature review and research techniques. Methods of solution: Analytical, numerical and experimental. Report, Dissertation and Thesis preparation: Abstract, introduction, analysis, experimental procedure, results, discussion, conclusions, recommendations and references. Publication: Referencing, citation, plagiarism, ethical and professional responsibility, journals and conferences ranking and impact factor. Research funding and financial support.

0903780 Smart Grids and Sustainable Electricity (3credits)
Smart grids; transmission and distribution networks perspectives. Distributed low carbon technologies. Photovoltaic systems: impacts and challenges. Decarburization of heat and transport. Electrical vehicles and heat pumps: impacts and challenges. Active network management. Congestion and voltage control of distribution networks with low carbon technologies. Sustainable electricity systems. Low carbon thermal generation. Wind generation. Cogeneration, micro CHP, tri-generation, heat storage, heat networks. System level integration challenges (operational reserves, impact on conventional generation, capacity credit). Emission models and indicators. Role of Storage facility and demand response to low carbon system operation.

0923781 High Voltage Engineering (3 credits)
Introduction to high voltage engineering. Conduction and breakdown in gases, liquids and solids. Applications of insulating materials. Generation of high voltages and high currents. Measurement of high voltages and current. HV overhead line insulators. Calculation of voltage distribution along insulators. High voltage bushings (types, design and applications). HV cables. Corona discharge. Circuit breakers.

0923782 Power System Planning and Reliability (3 credits)
Load Forecasting: peak demand and energy. Generation planning: capacity resource planning (conventional and nonconventional power plants), reliability and capacity reserve, generation expansion, cost analysis. Transmission planning: concepts, corridor selection for determining physical and electrical characteristics of lines to be constructed, reliability analysis. Distribution planning: types of distribution systems, planning for reliability, distribution system engineering: substation location, sizing and feeder location. Impact of renewable generation and deregulation on power system planning.

0923783 Power System Stability and Control (3 credits)
Synchronous machine characteristics: steady-state and transients analysis, introduction to power system stability: rotor angle stability, voltage stability, long and short term stability. Stability problem: swing equation, steady state stability, small disturbances, and transient stability, multi-machine systems, multi-machine transient stability. Power system control: introduction to basic control loops. Load frequency control: generator model, load model, prime mover model, governor model. Automatic generation control. Reactive power and voltage control: amplifier model, exciter model, generator model, excitation system stabilizer rate feedback. Excitation system stabilizer PID controller.

0923784 Advanced Power Electronics (3 credits)
Power electronics basics review. Non-isolated converters: Cuk converters. Isolated converter: forward converter, flyback converter, full and half bridge converter. AC/AC controllers: introduction, single and three phase converters, cycloconverters. Matrix converters. Multi-level inverters: concept and types of multilevel inverters: Diode clamped, flying capacitor, and cascaded multi-level inverters. Utility applications: high-

voltage DC transmission, flexible AC transmission systems, static VAR compensation, interconnection of renewables to the utility grid.

0923785 Advanced Power System Protection (3 credits)
Power system protection review. Distance protection schemes: permissive Under-reach transfer tripping, permissive overreach transfer tripping, directional comparison blocking, and direct transfer tripping. Rotating machines protection: stator and field faults and protection, loss of excitation, and abnormal voltages. Differential protection principles: line differential, transformer differential, and bus-bar differential: low and high impedance bus-bar protection. Numerical relaying: introduction, protection philosophy, basic hardware and protection schemes, protection algorithms, microprocessor application to protective relays, Matlab simulation of numerical relays. Communication schemes for power systems protection: power line carriers, optical fiber, and microwave. Protection schemes for the distribution network with distributed generators: protection philosophies and challenges, fault characteristics of renewables including PVs and wind generators. Adaptive relaying.

0933786 Renewable Energy and Distributed Generation (3 credits)
Drivers for renewable energy and incentives schemes. Wind power generation. Solar photovoltaic generation. Distribution networks with Distributed Generation (DG). Impact Studies of DG on distribution networks (power flow studies, fault studies, power quality studies and protection studies). Impact of DG on distribution network design. Connection costs and charges. Allocation of losses with DG. Pricing of distribution networks with DG.

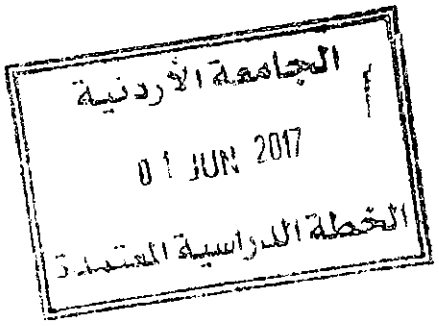
0943787 Power Distribution Systems (3 credits)
Distribution system planning and automation. Load characteristics. Application of distribution transformers. Design of Sub transmission Lines and distribution Substations. Design considerations of primary systems. Design considerations of secondary systems. Voltage drop and power loss calculations. Application of capacitors to distribution systems. Distribution system voltage regulation. Distribution system protection.

0923788 Power Systems Quality (3 credits)
Introduction to power quality, terms and definitions. Power quality problems, voltage sage, swell and interruptions. Overvoltage transient. Harmonics, source of harmonics, harmonics mitigation, harmonics filter design. Computer tools for harmonic analysis. Monitoring power quality. Solution to power quality problems. Standards and regulations. Study cases.

0933789 Power System Operation and Economics (3 credits)
Introduction to optimization and optimal economic system operation. Economic dispatch. Unit commitment. Electricity markets (forward and spot markets). Price risk management and contracts. Optimal power flow. Locational marginal pricing. Power

system security. Generation investments. Costing and pricing of transmission networks. Impacts of high penetration of renewable generation on power system operation. Role of storage and demand side management.

0903799 Thesis (9 credits)



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4.	Program title (English)	Master in Electrical Engineering/Power
5.	Track	None Thesis

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	Specialization					
Plan Number	31	8	65	69	2017	None Thesis

1. This plan conforms to the valid regulations of the programs of graduate studies.

2. Specialties of Admission:

- The First Priority: Bachelor in Electrical Engineering, Bachelor in Electrical Power Engineering

Second: Special Conditions: None.

Third: Study Plan: Studying (33) credit hours as following:

1. Obligatory Courses (24) credit hours:

Course No.	Course Title	Credit Hr.	Theory	Practical	Pre/Co-requisite
0903777	Research Methodology	3	3		-
0933741	Linear Systems	3	3	-	-
0903780	Smart Grids and Sustainable Electricity	3	3	-	-
0923781	High Voltage Engineering	3	3	-	-
0923785	Advanced Power System Protection	3	3		

الخطة الدراسية المعتمدة

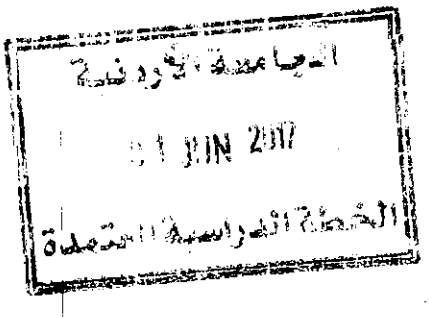
0933786	Renewable Energy and Distributed Generation	3	3	-	-
0943787	Power Distribution Systems	3	3	-	-
0933789	Power System Operation and Economics	3	3	-	-

2. Elective Courses: Studying (9) credit hours from the following:

Course No.	Course Title	Credit Hrs.	Theory	Practical	Pre/Co-requisite
0943701	Digital Signal Processing and Filtering	3	3	-	-
0923742	Advanced Control Systems	3	3	-	-
0923771	Electrical Machines and Drives	3	3	-	-
0923782	Power System Planning and Reliability	3	3	-	-
0923783	Power System Stability and Control	3	3	-	-
0923784	Advanced Power Electronics	3	3	-	-
0923788	Power Systems Quality	3	3	-	-

Comprehensive Exam 0903798

*notes



Course Description

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0903798 Comprehensive Exam