MASTER OF ENGINEERING (ELECTRICAL POWER)

PROGRAMME SPECIFICATIONS

The program is an advanced degree program to cater for graduates and professionals who are seeking and updating greater knowledge of current technology and techniques in electrical power, energy conversion, and high voltage engineering. The Master of Engineering (Electrical Power) offers high-level graduate program with strong foundations in theory, to equip student with the skills necessary to grasp and develop new technologies and trends in the electrical engineering field. It is designed to develop competent electrical power system professionals and the potentials of tomorrow's leaders in the power industry. The program prepares students to make an immediate contribution to the workplace and become leaders in the industry. Outstanding students can have the opportunities to further their studies leading to a Ph.D. degree.

Opportunity for BEM Electrical Engineering conversion
This program also provides opportunity for prospective students who currently registered as graduate engineers with BEM under the electronics category to convert to electrical category (terms and conditions apply, subject to approval from BEM).

Program Educational Objectives (PEO)

PEO1 Mastery of knowledge and competency in advanced areas of Electrical Power Engineering field.
PEO2 Professionalism and high standards of ethical conducts within organization and society.
PEO3 Responsive to changing situations by continuously acquiring new knowledge and skills.

Program Learning Outcomes (PLO)

PLO1 Attain advanced knowledge on theories, methods and applications related to Electrical Power Engineering field.
PLO2 Demonstrate mastery in conducting research independently in solving problems related to Electrical Power Engineering field through relevant analytical methods, simulations and/or experiments.
PLO3 Synthesize engineering knowledge through design and development.
PLO4 Plan and perform research undertakings responsibly, professionally and ethically.
PLO5 Communicate and express knowledge and ideas effectively.
PLO6 Continue life-long learning and apply technology for the betterment of humanity.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
MASTER OF ENGINEERING (ELECTRICAL POWER)					
SCHOOL COMPULSORY-12 CREDITS (4 COURSES)					
1	MKEP 1533	Power Electronics System	3	3	
2	MKEP 1553	High Voltage Insulation & Coordination	3	3	
3	MKEP 1603	Power System Analysis & Computational Method	3	3	
4	MKEP 1633	Power System Devices & Apparatus	3	3	
SCHOOL ELECTIVES-12 CREDITS (4 COURSES)					
5	MKEP 1513	Electronic Power Conversion	3	3	
6	MKEP 1523	Electrical Drives	3	3	
7	MKEP 1543	Advanced High Voltage Technology	3	3	
8	MKEP 1563	Power Quality	3	3	
9	MKEP 1613	Power System Control	3	3	
10	MKEP 1623	Power Transmission & Security	3	3	
11	MKEP 1643	Lightning Protection & Grounding System	3	3	
12	MKEP 1653	Integrated Resource Planning in Energy Sector	3	3	
13	MKEP 1663	Special Topic in Power Engineering	3	3	
14	MKEP 1673	Power System Protection	3	3	
15	MKEP 1683	Alternative Energy Technology System	3	3	
FREE ELECTIVES FROM MKEL/MKEM/MKEP/MKET-3 CREDITS (1 COURSE)					
16	MKEx 1xxx		3	3	
MASTER'S PROJECT-10 CREDITS (2 COURSES)					
17	MKEP 1814	Research Project Proposal	4	4	
18	MKEP 1826	Research Project Report	6	6	
TOTAL CREDIT OF ELECTRICAL ENGINEERING COURSES (a)			**37**	**37**	
SCHOOL/UNIVERSITY COMPULSORY- 6 CREDITS (2 COURSES)					
19	MKEU 0013	Introduction to Research Methodology in Electrical Engineering	3	3	
20	Uxxx xxx3	Non-technical subject	3	3	
TOTAL CREDIT OF SCHOOL/UNIVERSITY COMPULSORY COURSES (b)			6	6	
TOTAL CREDIT TO GRADUATE (a + b)			**43**	**43**	

COURSE SYNOPSIS

CORE COURSES

MKEP 1533 - Power Electronics System

This course provides an understanding of the principles of power electronic conversion systems and the ability to design power converters for certain applications. The topics covered are: 1. Concepts and prospects of power electronic systems: power switches, switching methods, drivers and losses in power electronics system. 2. ac-to dc conversion: rectifier with different loads, performance criteria, line distortion, effects of line inductance/overlap. 3. dc to dc conversion: non-isolated topologies-Buck, Boost, Buck-boost, CCM, DCM operation, non-idealities, isolated topologies-Flyback, Full-Bridge, switched-mode power supply, converter control. 4. dc to ac conversion: single-phase, three-phase, harmonics, square wave, PWM inverters, harmonics elimination PWM and multilevel inverter topologies. The focus is the design of power converters for specific applications such as utility, domestic appliance, electric vehicle and industrial applications.

MKEP 1553 - High Voltage Insulation & Coordination

This course provides an understanding of high voltage phenomena, and to present the concepts of high voltage insulation in power systems networks. The first part of the course stresses on the phenomena of conduction and breakdown in insulation materials in order to provide the students with a firm knowledge on high voltage phenomena and insulation technology. The second part of the course covers the introduction to dielectric properties of materials, diagnostic testing of insulation and insulation coordination. By adapting this knowledge, students will be able to develop essential technical skills in solving real-world problems involving insulation characteristics with some degree of acceptable conditions. The student will use software to solve engineering problems related to high voltage engineering applications.

MKEP 1603 - Power System Analysis & Computational Methods

This reviews basic Power Network Concepts, Power Transmission Lines Transformer and generator and their respective parameters and equivalent circuit models. Students will be taught how to formulate rigorously power system network model and Bus admittance matrix and to appreciate all assumptions made. The application of Bus admittance matrix to Fault Analysis and the application of symmetrical sequence components to unbalanced fault analysis is will be covered. Further application of the power system network model and numerical techniques will be used to solve Power Flow analysis using Newton-Raphson Method and the Decoupled Load Flow. The student is expected to write and develop basic fault analysis and load flow analysis program. The programs will be tested with IEEE test systems with the aim to achieve results comparable with commercial software. Commercial grade professional software will be used to design simple and practical reactive power and voltage control. The concept of Multi-machine transient stability analysis will be covered in the course, in order to understand large scale power system response to any power disturbance.

MKEP 1633 - Power System Devices & Apparatus

This course introduces students to relevant apparatuses and devices in the operation of power system engineering. It will initially involve discussions on features and characteristics of power system devices such as synchronous machines, transmission lines, and transformers. Then,

the dynamic aspects of the devices will be discussed. With the knowledge gathered, students are expected to be able to propose a design and perform relevant analysis on power system configurations consisting of the devices and apparatuses discussed in the course. Available computer packages such as MATLAB or PowerWorld can be used for better understanding of the relevant concepts related to the course. By integrating the knowledge, the students will be able to develop essential technical skills related to design and operation of power system.

ELECTIVE COURSES

MKEP 1513 - Electronic Power Conversion

This course basically relates to static power converters applications. It begins with the introduction of basic control concepts in the context of power electronic systems. Key definitions and concepts from feedback system theory are revisited for discussion related to regulation problem and feedback requirement of power converters. Models for control design are briefly introduced at the end of this topic. The next topic covered by the course is UPS system, which include UPS classification, applications, converter topologies and control methods. Active power filtering is also highlighted in this course. Some background on harmonics sources and effects are discussed followed by the mitigation methods. Active power filter classifications, concepts and control methods are covered quite extensively in this course. Finally, some industrial and residential applications of power converters are dealt with for a complete picture on static applications of power converters.

MKEP 1523 - Electrical Drives

The course introduces students to the fundamentals of electrical drives. The basics of electrical drives, such as the fundamental torque equations, main components of electrical drives, various characteristics of load and motors as well as multi-quadrant operations of electrical drives are covered in the introduction section of the course. The analysis and controller design of typical power electronic converters used in the electrical drives are studied with the help of MATLAB/SIMULINK simulation package. Specific examples of controller design for DC drives are presented. The scalar control using the constant V/Hz for induction motor drives based on steady-state per-phase equivalent circuit is discussed. These include the slip-compensation, current controlled, open loop and closed loop structures of constant V/Hz scheme. Finally, the dynamic modelling of induction machine is introduced. Using the dynamic model, the high-performance induction motor control schemes such as the field-oriented control and the direct torque control are presented and analyse using MATLAB/SIMULINK

MKEP 1543 - Advanced High Voltage Technology

There have been a number of key advances in the area of high voltage technology. This course reviews basic as well as recent reconsideration related to partial discharges and their measurement, overvoltages and insulation coordination on transmission networks, zinc oxide surge arresters, and SF6 insulation systems and their monitoring. The course also reviews various numerical analyses of electrical fields in high voltage equipment, optical measurements and monitoring in high voltage environments, and pulsed power principles and applications. The student is expected to be able to critically apply key advances in high voltage technology to solve problems in power engineering and to design the insulation coordination for a given transmission network.

MKEP 1563 - Power Quality

The power quality course deals with the understanding of electrical power quality and its effect on power system performance. The course begins with the fundamental concepts on power quality. Next, the different power quality issues, their sources and effects and different related standards are presented. For each type of disturbances, case-study examples and concepts are provided. Following that, the solution of the problem is discussed in order to understand and maximize the available benefits. At the end of the course, the measurement technique is introduced to expose an idea commonly present in the actual system. By combining the knowledge obtained, students will be able to conduct power quality measurement, analysis the data and suggest suitable mitigation for different types of the power quality problem.

MKEP 1613 - Power System Control

The main goal of this course is to provide students with an overview of the engineering matter involved in designing, operating and controlling the power generation and transmission of a large-scale, interconnected power system. The objective is to provide knowledge on the importance of the different systems, the functionality they provide, the data used and exchanged as well as the development of these systems. At the conclusion of the course, students should be able to design and simulate a typical power system and analyze with the help of MATLAB/SIMULINK or Power World simulation packages. By adapting this knowledge, students will be able to develop essential technical skills in solving real problems in power system control by following the IEC standard or at least Malaysian Standard.

MKEP 1623 - Power System Transmission and Security

This course is divided into 2 parts: The first part introduces students to power systems transmission system while the second part introduces students to power systems security. In the first part, it will cover the power transmission in details ranging from transmission line modelling to transmission line design. Key issues such as transmission losses in determining the economic dispatch of power system will be covered. In the second part, it will cover the issue of power system security in which the concentration will be given involving transmission system security. The concept of contingency analysis, N-1 security will be discussed. Then the issue of congestion management and allocation in deregulated electricity market will be covered in this course.

MKEP 1643 - Lightning Protection and Grounding System

This course will cover the following areas: lightning phenomena; earth performance under lightning current as well as under short-circuit condition; lightning related damages, lightning parameters, lightning surge propagation in transmission lines, lightning effects on human being and animals, principle of lightning protection based on IEC standard, lightning protection for building structures, lightning protection of transmission line and shielding failure, interaction of lightning with low voltage; and introduction to earthing systems: resistance value; measurement of soil resistivity and earth resistance value, step potential, touch potential and transfer potential, soil characteristics under impulse condition, transmission-line tower earthing installation, computer network earthing, design of AC substation earthing system.

MKEP 1653 - Integrated Resource Planning in Energy Sector

This course is designed to give an overview understanding of energy supply, demand, energy balance and sustainability issues. It covers the assessment of past, current and future energy system and provides the analytical framework and assessment methodologies needed to

promote Integrated Recourse Planning (IRP) in electricity sector. IRP is the process of selecting an electric resources mix on the basis of comparing the benefits and costs of demand and supply resources. By adapting this knowledge, student will be able to develop essential technical skill in solving real-world problem of providing electricity at lowest possible economic, social and environmental cost.

MKEP 1663 - Special Topic in Power Engineering

The aim of the Special Topic course is to provide a mechanism for one-off topic to be offered by any graduate faculty or visiting professor. The topic of any Special Topic course has to be vetted and endorsed by the Faculty's Academic Committee.

MKEP 1673 - Power System Protection

This course introduces students to some major views, theories and applications in the area of power system protection. It will examine some key issues in overcurrent protection with special focus in IDMT relay application in power system network. The course will also discuss on distance, differential and load shedding protection. The students will also be taught with the topic related to power system fault diagnostic. The students are expected able to evaluate the performance of power system protection. By mastering this knowledge, students will be able to interpret various causes of fault in power system.

MKEP 1683 - Alternative Energy Technology Systems

This course provides in depth coverage of alternative energy technology (AET) systems that includes solar/photovoltaics (PV) energy, wind energy, fuel cells, microturbines etc. Emphasis will be placed on the energy flow, power management, hybridization, energy conversion and control, storage element, testing and integration with the utility grid. In addition, various storage devices for the incorporation of AET system and the associated power electronic converters will be discussed and analyzed. This course also covers the design, simulation and analysis of several AET system applications. With these fundamental exposures, students should be able to design simple AET systems for the application of distributed generation, grid connected systems, rural electrification and electric/hybrid vehicles.