UNIVERSITI TEKNOLOGI MALAYSIA
FACULTY OF ELECTRICAL ENGINEERING

GRADUATE STUDIES
IN
ELECTRICAL ENGINEERING

MASTERS AND DOCTORAL DEGREES

ACADEMIC SESSION 2009/2010

www.fke.utm.my/postgraduate

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Preface

Welcome to the graduate Faculty of Electrical Engineering. Our postgraduate taught courses and research programs offer excellent academic programs, which will challenge your abilities, and a training that will help you to develop skills, required for your future career. As a research student, you will work on exciting and relevant projects supervised by graduate faculty member expert and an enthusiast in your field, using first class facilities.

The majority of our taught postgraduate programs have a structure consisting of core compulsory courses subject with a various choice of optional courses related to specific area of specialization. In most cases, this structure offers the flexibility to extend students academic interests into new areas. A taught postgraduate program is also an excellent program to further postgraduate study towards a research work leading to a Ph.D. degree.

We welcome application from individuals seeking top priority postgraduate programs in all areas of electrical and electronic engineering. Our part time programs cater for all working engineers through flexible and various programs. We look forward to you, joining out postgraduate community and we will seek to ensure that you enjoy not only your academic study but also all the facilities at UTM.

Dato' Prof. Dr. Ahmad bin Darus
Dean,
Faculty of Electrical Engineering.

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UNIVERSITI TEKNOLOGI MALAYSIA

Universiti Teknologi Malaysia (UTM) strives for academic excellence through creative learning and state of the art technology. UTM has two campuses, the 1,222 – hectare main campus in Skudai, Johor which is about 18 kilometers from the city of Johor Bahru at the southern tip of Peninsular Malaysia and 18 – hectare city campus situated at Jalan Semarak, Kuala Lumpur . UTM is proud to be the center of excellence through dedication to develop science and technology to compete in the global arena. Our dedicated professionals and technical staff provide support to the postgraduate programs and continuing education, as a preparation to meet the challenges of the millennium. Together with extensive international academic collaborations (more than 50 institutions throughout the world), UTM is capable of offering competitive and exciting postgraduate programs.

Currently, the University has a wide range and depth of more than 100 postgraduate programs in Engineering and Technology served by more than 500 committed graduate faculty members with broad international exposure. UTM also has more than 30 years of experience in tertiary level engineering education and has produced more than 85,000 graduates, including 6, 026 postgraduates.

UTM, one of Malaysian's leading universities for engineering and technology has

- A mission to be a world class center of academic and technological excellence through creativity
- A reputation for innovative education and leading-edge research, educating the technologist and professional
- More than 20,000 students on campus in Johor, more than 4,500 in Kuala Lumpur campus and about 5,000 students on distance learning /part time programs
- More than 3,000 postgraduate students in various fields of specialization
- More than 20 specialized institutes and research centers, in addition to academic departments to service the technology, education and research needs
- More than 100 postgraduates programs offered at Master's and Doctorate Level.

SCHOOL OF GRADUATE STUDIES (SPS)

School of Graduate Studies was established in 1985 as the graduate programs expanded rapidly in UTM. The school provides a focus for postgraduate activities across the University. It reflects the central place held by postgraduate education in the University's mission. Today's employers are looking for more than just high academic achievers in their new recruits. They are seeking highly adaptable individuals who are equipped both with a deeper understanding of their chosen field and with the knowledge, skills and means to operate at national and international level. We are committed to the principle of 'Lifelong Learning', believing that your education should begin, not end, with graduation. By taking your education that one stage further, you will not acquire new expertise and knowledge which will make you an asset to any employer, but it will also allow you to spend more time broadening your mind and gaining new experiences.

The School of Graduate Studies (SPS) is responsible for ensuring that prospective local and international students have all the information they need to make the right choice and then to facilitate their postgraduate admission to UTM. SPS is responsible to coordinate the academic programs with the faculty and maintain the quality of education. The School of Graduate Studies also administers the academic records and examination of postgraduate students in UTM with the coordination from all the ten faculties.

The roles of SPS are to:

- Support the mission of the university to become a world class center of academic and technological excellence
- Formulate policies pertaining to the development of graduates studies
- Steer the postgraduate committee and coordinate with academic faculties to develop and enhance the quality of the graduate education
- Maintain the integrity in the graduate education practices across all departments and center in UTM
- Cooperate with other departments of the University to ensure that facilities are available to meet both the academic and social need of graduates students
- Facilities staff and student training sessions on aspects of graduate education
- Innovative new initiatives in graduate education to face new challenges

FACULTY OF ELECTRICAL ENGINEERING

Mission and Organization

The **FACULTY OF ELECTRICAL ENGINEERING** postgraduate degree programs prepare students for both professional careers and advanced study, with a strong foundation of basic principles. The programs use formal classroom instruction, seminars, and self directed studies to prepare graduate students to develop both technically and contextually appropriate solutions. Research is an integral part of postgraduate degree programs, providing research areas and opportunities for graduate student interactions with expert academics and outside professionals. Some of these research areas includes electronics, microelectronics, computer engineering, information technology, telecommunications, mechatronics, robotics, control engineering, electrical power engineering and energy conversion. Besides meeting the requirements of advanced academic study, the research projects are designed to enhance economic use of our material resources and to promote well-balanced industrial and professional development. The active research environment provides the academic staff, researchers and graduate students with the latest facilities and technology necessary for quality research work, relevant to today's electrical engineering field. The *graduate faculty*, which currently consists of a total of 73 professors, associate professors and lecturers with PhDs, provides extensive research competence and engineering expertise, to perform applied research addressing problems of state, national and international importance. The *Graduate Faculty* is supported by 40 trained technicians. This staff strength, coupled with state-of-the-art research facilities in 40 computer and engineering laboratories, ensure the teaching, learning and research activities always maintain high academic standards and of world-class quality. Researches are funded by grants from both the government and industry. For the past three years, the faculty has succeeded in securing, on the average, a total of RM 7 million a year in research grants. The faculty also provides important educational services to industries, professions, and the general public. Short courses, conferences and workshops taught by the faculty provide valuable interactions among professionals in the electrical engineering field. Currently, undergraduate enrollment is around 3000, while postgraduate student enrollment is about 600, which should reach a target of about 700 in 2010. The faculty is organized into eight departments and five centers of excellence, as listed below.

Departments:

1. Dept. of Electrical Power Engineering (POWER)
2. Dept. of Energy Conversion Engineering (ENCON)
3. Dept. of Mechatronics & Robotics (MER)
4. Dept. of Control Eng. & Instrumentation (CIED)
5. Dept. of Microelectronics & Computer Eng. (MiCE)
6. Dept. of Electronic Engineering (INSEED)
7. Dept. of Optic & Telematics Communication Eng. (TOP)
8. Dept. of Radio Communications Eng. (RaCED)
9. Dept. of OffCampus Programmes
10. Dept. of Postgraduate Studies

Centers of Excellence (CoE)

1. Institute of High Voltage & High Current (IVAT)
2. Centre of Artificial Intelligence & Robotics (CAIRO)
3. Wireless Communication Centre (WCC)
4. Photonics Technology Centre (PTC)
5. Centre of Electrical Energy System (CEES)

Dean's Office

Dato' Professor Dr Ahmad Darus
Dean, Faculty of Electrical Engineering

Professor Dr Johari Halim Shah Osman
Deputy Dean (Research & Postgraduate Studies)

Professor Ir. Dr Abdul Halim Mohamed Yatim
Deputy Dean (Academic & Continuing Education)

Hj Ahmad Musthafa Jamil
Deputy Registrar

Puan Nurul Asyikin Ngadiso
Assistant Registrar

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Deputy Dean (Research & Postgraduate Studies)/Chairman

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Director, Inst. of High Voltage & High Current

Professor Dr Rubiyah Yusuf
Director, Centre of Artificial Intelligence & Robotics

Associate Professor Dr Norazan Mohd Kassim
Director, Photonics Technology Centre

Professor Dr Tharek b. Abdul Rahman
Director, Wireless Communication Centre

Professor Dr Khalid Mohamed Nor
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Associate Professor Dr Mohd. Wazir Mustafa
Head, Dept. of Electrical Power Engineering

Associate Professor Dr Abu Sahmah Supaat
Head, Dept. of Optic and Telematics Communication Engineering

Associate Professor Dr Yahaya Md Sam
Head, Dept. of Control Engineering & Instrumentation

Associate Professor Dr Ahmad Zuri Shaameri
Head, Dept. of Microelectronics & Computer Engineering

Associate Professor Dr Mohamad Ngasri Dimon
Head, Dept. of Radio Communications Engineering

Associate Professor Dr Nik Rumzi Nik Idris
Head, Dept. of Energy Conversion Engineering

Associate Professor Dr Mohamad Noh Ahmad
Head, Dept. of Mechatronics & Robotics

Associate Professor Dr Jafri Din
Head, Dept off Campus Program

Associate Professor Dr Syed Abd. Rahman Syed Abu Bakar
Head, Dept of Postgraduate Studies

Hj Ahmad Musthafa Jamil
Deputy Registrar /Secretary

Working Committee for Research and Graduate Studies

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Main-Campus Program Coordinator

Associate Professor Dr Mohd Wazir Mustafa
Off-campus Program Coordinator (Kulim)

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Program Coordinator MIMOS – FKE

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Off Campus Program Coordinator (Kuala Lumpur)
Control Engineering Coordinator

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Off Campus Program Coordinator (Kuala Lumpur)
Communication Engineering Coordinator

Dr. Shaikh Nasir Shaikh Husin
Of campus program Coordinator (Penang)
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POSTGRADUATE STUDIES

Degrees

The Faculty of Electrical Engineering offers postgraduate programs leading to the degrees of Master of Engineering (M.Eng) and the Doctor of Philosophy (Ph.D) in Electrical Engineering. The Master programs are conducted in either one of three modes of study – research, taught course or coursework & dissertation. The degrees offered are listed below.

	Mode of Study
▪ **Ph.D (Electrical Engineering)**	by Research
▪ **M Eng (Electrical)**	by Research
▪ **M Eng (Electrical – Power)**	by Taught Course
▪ **M Eng (Electrical – Electronics & Telecommunications)**	by Taught Course
▪ **M Eng (Electrical – Mechatronics & Automatic Control)**	by Taught Course
▪ **M Eng (Electrical – Computer & Microelectronic System)**	by Taught Course
▪ **M.Eng (Communication Engineering)**	by Taught Course and Research

Doctor of Philosophy and Masters degree by Research Programs

Degrees granted: PhD (Electrical Engineering); M.Eng (Electrical)

The doctorate program is by research only. The period of study for the PhD degree is at least three years (six semesters) beyond the baccalaureate degree. However, the normal period of full-time study requires duration of 3 years. The minimum period of candidature is two years. Students can register for a full-time study or part-time. The minimum period of candidature for the completion of the program leading to a Masters degree is one year. Students can register for a full-time study or part-time. A full-time study in this Masters program normally requires duration of 2 years.

An academic staff (or panel) from graduate faculty will supervise the graduate student. Co-supervisors may come from the industry. The progress of a candidate is assessed through research progress reports submitted at the end of each semester. The degree is awarded based on a comprehensive examination (v*iva voce*) of the thesis submitted by the candidate on completion of study. Prospective graduate students should prepare themselves adequately, both in the fundamental subject matter necessary for advanced work and other branches of learning, so they may conduct quality research and successfully complete their programs. These research-based programs are available in the following fields of study/research as listed below. The graduate students should choose research topics from these **Major Research Areas**:

Electrical Power Engineering

Power Systems Planning & Analysis, Power System Protection, Power Quality, Deregulation Electricity Market, High Voltage Engineering, HV Insulation & Electrical Discharges, Lightning Protection & Grounding, Energy Efficiency, Renewable Energy, Photovoltaic Technology, Energy Conversion Engineering, Power Electronics & Electrical Drives.

Control Engineering

Robotics, Mechatronics, Advanced Control System Design, Automatic Control & Industrial Automation, Tomography & Instrumentation, Advanced Process Control, Intelligent Control Systems, Artificial Intelligence.

Electronics & Computer Engineering

Biomedical Electronics & Instrumentation, Analog Electronics Design, Microelectronics, Digital Signal Processing, Image Processing, Speech & Audio Signal Processing, Microprocessors & Digital Systems, System Level Design & VLSI, Computer Systems Engineering, Network Systems & Security.

Communications Engineering

Communication Networks, Telematics, Computer Networking, Photonics, Optical Communications, Radio Communications, Mobile & Wireless Communications, Micro Electro-Mechanical System (MEMS), Acoustics Engineering, RF and Microwave Engineering Design, Active and Passive Antenna Design

Thesis Submission and Examination

In the 2nd semester of the Masters' program and in the 3rd semester of the PhD program, respective research students will undergo a first stage evaluation process. The objective of this evaluation process is to assist and ensure students so that the research they are carrying out are following in the right direction and eventually meet the expectation of the research. Students will receive a copy of the panel report containing suggestion and recommendation that will guide and improve the undertaken work.

Prior to submission of the thesis for the oral examination (viva), students must submit a **Thesis Submission** form at least 3 months before. This is to ensure that approved internal and external examiners have been appointed by the university before the oral examination can take place. Failure to do so may delay the viva process.

Master of Electrical Engineering by Taught Course Programs

Degrees granted: M.Eng (Electrical – Mechatronics & Automatic Control); M.Eng (Electrical – Electronics & Telecommunications); M.Eng (Electrical – Power); M.Eng (Communications Eng.); M.Eng (Computer & Microelectronics System).

Program Structure. Graduate students can pursue a full-time or part-time taught course program. The full-time study requires a minimum duration of three semesters, while the part-time program takes, at least, four normal semesters and one 8-week short semester (about two years). The University's Main Campus in Skudai offers only full-time coursework programs (*Perdana* Programs), while the part-time coursework programs (Off-campus Programs) are only available at the University's City Campus in Kuala Lumpur or other centers.

Teaching Methods. A taught module takes the following forms: formal lectures, tutorials and assignment and/or laboratory work. Each 3-credit module is delivered in 38 to 42 hours of lectures. Teaching/learning is student-centered; hence it must be complemented with adequate self-study and self-learning by the candidate. Part-time taught course programs involve modular teaching and distance learning, with lectures being delivered on weekends.

Assessment and Grading. Students' progress is assessed (continuously) throughout the semester by a coursework assessment component and a final examination for each module. The coursework component may consist of set written assignments, practical work/lab assignments, and short tests. Total mark for each taught module will be 100%. The following table shows the mapping between score, grade, and grade point received.

Score	Grade	Grade Point
90 - 100	A+	4.00
80 - 89	A	4.00
75 - 79	A-	3.67
70 - 74	B+	3.33
65 - 69	B	3.00
60 - 64	B-	2.67
55 - 59	C+	2.33
50 - 54	C	2.00
45 - 49	C-	1.67
40 - 44	D+	1.33
35 - 39	D	1.00
30 – 34	D-	0.67
0 – 29	E	0

Passing mark for each taught module is 60% or equivalently B-. Students that fail a core subject must repeat the same subject while students fail an elective subject may replace it with other elective on approval from the Postgraduate department.

In order to continue to the subsequent semester, students must obtain at least 2.67 *cumulative grade point average* (CGPA) or equivalently a B- average for each semester. This is considered as *Conditional Pass*. For a Masters degree to be awarded, candidates must complete a minimum of 41 credits and achieve a final academic grade point of at least 3.0 CGPA. The following table shows the academic standing and students' status.

Academic Standing	CGPA	Students' Status
KB – Good Pass	≥ 3.00	proceed to next semester and eligible to graduate upon completing 41 credits
KS – Conditional Pass	2.67 ≤ CGPA < 3.00	Proceed to next semester but not entitle to degree conferment upon completing 41 credits
KG - Fail	< 2.67	Dismissal of student status

Students may also register a module under *HS* (attendance only). In order for this module to appear in the transcript, students' attendance must be at least 80%.

Master Project. Another requirement towards the conferment of the Masters degree is that each student must undertake the master project. This 1 year project will be supervised by a Graduate faculty lecturer of the University. Towards the end of the 1st semester, students will present a short presentation regarding the project. At the end of the work, a comprehensive project report/thesis must be submitted. This project may take one of two forms: ***Industry project.*** Such a project will require the agreement of the industry sponsor who will define the industrial requirements of the project. The project must still meet academic requirements, defined by the academic supervisor. An industry co-supervisor may be appointed from persons with appropriate academic standing or experience, acceptable to the Graduates Committee. ***Academic project.*** Such project will be under taken in the Faculty's laboratories. The project may be motivated by an industrial problem, or it may be theoretical, experimental or design-based.

Program Code

M – Master Level
P – Ph D level
E – Faculty of Electrical Engineering
L – Electronics and Telecommunication Engineering
P – Power Engineering
M – Mechatronic and Control Engineering
H - Computer and Microelectronic System
G - Communication Engineering

List of Programs offered

	Program Code	Program	Name of Program/Degree	by	Program Type	Register Type
1	PEEA3AJA	PEE	PhD (Electrical Engineering)	Research	*Perdana*, Skudai	Full-time, Part-time
2	MEEA3AJA	MEE	MEng (Electrical Engineering)	Research	*Perdana*, Skudai	Full-time, Part-time
3	MELA1AJA	MEL	MEng (Electrical - Electronics & Telecomunications	Taught Course	*Perdana*, Skudai	Full-time
4	MEPA1AJA	MEP	MEng (Electrical - Power)	Taught Course	*Perdana*, Skudai	Full-time
5	MEMA1AJA	MEM	MEng (Electrical - Mechatronics & Automatic Control)	Taught Course	*Perdana*, Skudai	Full-time
6	MELA1BKA	MEL	MEng (Electrical- Electronics & Telecomunications	Taught Course	Off-campus, KL	Part-time
7	MEPA1BKA	MEP	MEng (Electrical – Power)	Taught Course	Off-campus, KL	Part-time
8	MEMA1BKA	MEM	MEng (Electrical – Mechatronics & Automatic Control)	Taught Course	Off-campus, KL	Part-time
9	MELA1BHA	MEL	MEng (Electrical- Electronics & Telecomunications	Taught Course	Off-campus, Kulim	Part-time
10	MEHA1AJA	MEH	MEng (Electrical - Computer and Microelectronics System)	Taught Course	Perdana Skudai	Full Time
11	MEHA1BPA	MEH	MEng (Electrical - Computer and Microelectronics System)	Taught Course	Off-campus Penang	Part- time
12	MEGA2AJA	MEG	MEng (Communication Eng.)	Taught course & Research	Perdana Skudai	Full Time

Curricula, Taught Course Programs

Degree: MEng (Electrical–Electronics & Telecommunications)

Programs: **MEL**

Total Credit: **41 credits**
Specialization: Electronics, Communications & Computer Engr.

University Compulsory Elective (3 credits):		***credit***
UHx xxxx	*Non-technical Subject*	3
Faculty Compulsory Modules (12 credits):		
MEL 1123	Advanced Microprocessor Systems	3
MET 1313	Communications & Computer Networks	3
MET 1413	Advanced Digital Communication	3
MEL 1153	CAD for Electronic Design	3
Faculty Electives – Choose 4 modules (12 credits):		
MEL 1113	Nanoelectronic Devices	3
MEL 1133	Integrated Circuit Testing	3
MEL 1143	Advanced Digital Signal Processing	3
MEL 1223	Random Process	3
MEL 1233	Image Processing	3
MEL 1243	Software Engineering	3
MET 1323	Broadband Multimedia Networks	3
MET 1333	Optical Communications	3
MET 1383	Satellite Communication	3
MET 1393	Network Modeling & Performance	3
MET 1423	Wireless Communication Systems	3
MET 1433	RF/Microwave & Antenna Design	3
MET 1463	Advanced Communication Electronics	3
MEL 1263	Special Topic in Electronic Engineering	3
MET 1453	Special Topic in Telecommunication Eng.	3
Masters Research Project (8 credits)		
MEL 1813	Research Project Proposal	3
MEL 1825	Research Project Thesis	5
Free Electives – Choose any 2 subjects (6 credits)		
(From MEP/MEM/MEH/MEG)		6

Degree: MEng (Electrical - Power)

Programs: MEP

Total Credit: 41 credits
Specialization: Electrical Power Engineering

University Compulsory Elective (3 credits):		***credit***
UHx xxxx	*Non-technical Subject*	3

Faculty Compulsory Modules (12 credits):		
MEP 1533	Power Electronics System	3
MEP 1553	High Voltage Insulation & Coordination	3
MEP 1603	Power System Analysis & Computational Method	3
MEP 1633	Power System Devices & Apparatus	3

Faculty Electives – Choose 4 modules (12 credits):		
MEP 1513	Electronic Power Conversion	3
MEP 1523	Electrical Drives	3
MEP 1543	Advanced High Voltage Technology	3
MEP 1563	Power Quality	3
MEP 1613	Power System Control	3
MEP 1623	Power Transmission & Security	3
MEP 1643	Lightning Protection & Grounding System	3
MEP 1653	Integrated Resource Planning in Energy Sector	3
MEP 1663	Special Topic in Power Engineering	3
MEP 1673	Power System Protection	3
MEP 1683	Alternative Energy Technology System	3

Masters Research Project (8 credits)		
MEP 1813	Research Project Proposal	3
MEP 1825	Research Project Thesis	5

Free Electives – Choose any 2 subjects (6 credits)	
(From MEL/MEM/MEH/MEG)	6

Degree: M Eng(Electrical–Mechatronics & Automatic Control)

Programs: MEM

Total Credit: 41 credits
Specialization: Control Engineering, Mechatronics & Robotics

University Compulsory Elective (3 credits):		***credit***
UHx xxxx	*Non-technical subject*	3

Faculty Compulsory Modules (12 credits):		
MEM 1753	Advanced Instrumentation & Measurement	3
MEM 1833	Linear System Theory	3
MEM 1853	Discrete-Time Systems & Computer Control	3
MEM 1863	Design of Microprocessor-Based Mechatronic Systems	3

Faculty Electives – Choose 4 modules (12 credits):		
MEM 1713	Artificial Intelligence	3
MEM 1723	Advanced Process Control	3
MEM 1733	Adaptive & Self-Tuning Control	3
MEM 1743	Modeling & Simulation of Dynamical Systems	3
MEM 1763	System Identification & Estimation	3
MEM 1773	Multivariable and Optimal Control System	3
MEM 1783	Nonlinear and Robust Control Systems	3
MEM 1823	Advanced Robotics	3
MEM 1843	Advanced Digital Control	3
MEM 1873	Real-Time Control System Design	3
MEM 1883	Autonomous Mobile Robotics	3
MEM 1893	Special Topic on Control	3

Masters Research Project (8 credits)		
MEM 1813	Research Project Proposal	3
MEM 1825	Research Project Thesis	5

Free Electives – Choose any 2 subjects (6 credits)	
(From MEL/MEP/MEH/MEG)	6

Degree: M Eng. (Computer & Microelectronic System)

Programs: MEH

Total Credit: 41 credits
Specialization: Computer Engineering, Microelectronics & IC Design

University Elective (3 credits):		***credit***
UHx xxxx	*Non-technical subject*	3

Faculty Compulsory Modules (12 credits):		
MEL 1113	Nanoelectronic Devices	3
MEL 1123	Advanced Microprocessor Systems	3
MEL 1173	Advanced Digital System Design	3
MEL 1193	Analog CMOS Design	3

Faculty Electives – Choose 4 modules (12 credits):		
MEL 1133	Integrated Circuit Testing	3
MEL 1143	Advanced Digital Signal Processing	3
MEL 1163	VLSI Circuits & Design	3
MEL 1183	Advanced Computer Architecture	3
MEL 1223	Random Process	3
MEL 1233	Image Processing	3
MEL 1243	Software Engineering	3
MEL 1253	Speech Processing	3
MEL 1263	Special Topic in Electronic Engineering	3

Masters Research Project (8 credits)		
MEH 1813	Research Project Proposal	3
MEH 1825	Research Project Thesis	5

Free Electives – Choose any 2 subjects (6 credits)	
(From MEP/MEM/MEL/MEG)	6

Degree: M Eng (Communications Engineering)

Programs: MEG

Total Credit: 42 credits
Specialization: Communications

University Elective (3 credits):		***credit***
UHX xxxx	*Non-technical subject*	3

Faculty Compulsory Modules (12 credits):		
MET 1313	Communications & Computer Network	3
MET 1333	Optical Communications	3
MET 1423	Wireless Communication System	3
MET 1433	RF/Microwave & Antenna Design	3

Faculty Electives – Choose 2 modules (6 credits):		
MEL 1143	Advanced Digital Signal Processing	3
MET 1323	Broadband Multimedia Network	3
MET 1363	Secured Digital Communication	3
MET 1373	Sonar & Acoustic Engineering	3
MET 1383	Satellite Communication	3
MET 1393	Network Modeling & Performance	3
MET 1413	Advanced Digital Communication	3
MET 1443	Electromagnetic Compatibility	3
MET 1463	Advanced Communication Electronics	3
MET 1473	Radar & Communication Based System	3
MET 1483	Optical Network & Devices	3

Masters Research Project (21 credits)

MEG 1X80	Research & Dissertation	21

X – denotes current registered semester

Master of Electrical Engineering By Coursework Programs

Course Synopsis

Electronics – MEL

MEL 1113 Nanoelectronic Devices

Semiconductors form the basis of most modern electronics systems. This course is designed to provide a basis for understanding the characteristics, operation, and limitations of semiconductor devices. In order to gain this understanding, it is essential to have a thorough knowledge of the physics of the semiconductor material. The goal is to bring together quantum mechanics, the quantum theory of solids, semiconductor material physics, and semiconductor device physics. All of these components are vital to the understanding of both the operation of present day devices and any future development in the field. This course is a continuation to Microelectronics at undergraduate level and introduces advance device concepts.

MEL 1123 Advanced Microprocessor System

This course is about microprocessors in embedded systems. Embedded systems are hidden in everyday electronic devices, such as cell phones, DVD players, automobiles, or even a few toasters. The military uses embedded systems to guide missiles, pilot UAVs and detect enemy targets. Other examples of embedded systems are communications satellites, deep-space probes and many medical instruments. Unlike microprocessors used in general purpose computer systems, embedded microprocessors are usually designed to perform a certain task and the user seldom has to interact with it. This course extends the students knowledge of microprocessors by investigating embedded systems design and state-of-the-art 32-bit embedded processors. The student will be familiarized with problems associated with producing software and software in high-level language and assembly language for embedded systems. The topics covered include high-level and assembly language programming for embedded microprocessors, memory and peripherals for embedded systems, system development, and achieving high-performance in embedded systems.

MEL 1133 Integrated Circuit Testing

In this course students will be taught on the importance of testing as one of components in IC manufacturing industry. It begins with the introduction of economic costs to carry out test procedures. To test faults it is required to understand and appreciate their types and how they are modeled. This covers for combinational, sequential and memory circuits. IDDQ test method is also presented as an alternative and complement test method. Discussion will include its advantage, disadvantage and challenge to practically implement and design a current sensor. Advanced topics which include DFT and BIST are included to create awareness of its importance in today's IC design and test activities. Standard method of test pattern generation and test compaction using LFSR would be the main part in this topic. This is supported by other architectures such as CA and its variations.

MEL 1143 Advanced Digital Signal Processing

This course introduces students to advanced concepts in digital signal processing. In the beginning, basic concepts in signal processing will be reviewed that covers continuous and discrete-time signals and systems with the relevant transformations and operations. Random signal principles are presented with, definition of stationarity and ergodicity, correlation and covariance functions and their

estimates. The power spectrum of signals is defined together with the relationship with to the correlation function. Linear systems with random inputs are defined in terms of autocorrelation and cross correlation function and power spectrum. Optimum filtering techniques such as matched filter and wiener filter are presented with examples of applications. Basic constraints in non parametric power spectrum estimation are described with the appropriate solutions. Linear estimation techniques deal with parameter identification and estimation of signals. Linear prediction is used for signal modelling and prediction. The solution is obtained based on the solution to the normal equation and its efficient implementation using the, Levinson-Durbin algorithm. Towards the end of the course, signal analysis and representation techniques for time-varying signals are presented such as the short-time Fourier transform, Gabor transform and wavelet transform.

MEL 1153 CAD for Electronic Design

This is a course that goes beyond the introductory course on digital basic principles and techniques. This course introduces digital circuit modelling with hardware description languages (HDLs), which is the key technique to modern design of integrated circuits (ICs). The technique involves a CAD approach in which a high-level, text-based, abstract description of the circuit is created, then synthesized to a hardware implementation in a selected technology, and finally verified for its functionality and timing. The course is presented in a "**ASK**" manner such as to **attract** students to the state-of-the-art technique, to enable the students to **simplify** the complex task of design, and to apply the **knowledge** in practice.

MEL 1163 VLSI Circuits & Design

In this course, students learn about VLSI design, with emphasis on designing circuits to meet certain performance criteria. Important issues when designing a VLSI circuit are discussed.MOS transistors are reviewed, including their characteristics, structure, switch-level behaviour, and current equation. SPICE model of a MOS transistor is also described. The inverter circuit is studied in detail.IC fabrication process is reviewed. Layout, design rules and stick diagram are explained.This course emphasizes circuit design for speed and power performances. Factors that affect speed are explained. Logical effort concept is introduced to explain how to design a fast circuit. Similarly, effect of input signal transitions on power dissipation is explained.

MEL 1183 Advanced Computer Architecture

This course presents the advanced techniques of digital system design. This includes algorithmic synthesis techniques and RTL design optimization techniques of serial, concurrent and pipelining. Microprogramming and the design of microcoded control units are also introduced. The course teaches the RTL methodology to follow a model architecture through the design process, from the instruction set architecture to the processor design level. High performance architectures with cache memory are also studied.

MEL 1193 Analog CMOS Design

In this course students will be taught on the importance to understand and appreciate the characteristics of MOSFET transistor as a prerequisite of CMOS analog design. It highlights the nonlinearity as an imperfection which will limit the performance of analog circuits. The course will then proceed to analyze CMOS single ended as well as differential amplifiers. The advantages and disadvantages between different architectures will be discussed which designers could choose to fit their design requirements. The trademark of analog design which is the design challenge to fulfill design matrix will be highlighted. Other important sub-modules such as differential amplifier, Op Amps, switch capacitor amplifiers and oscillators will be addressed towards the end of the course.

MEL 1223 Random Processes

This course introduces students to introductory level of random variables and random process. In the beginning students will be introduced to

the concept of probability and its axioms, Bayes' theorem, combinations and permutations. Then the concept of random variable which includes probability density and cumulative functions will be given. This topic will be extended to operations on random variable such as expectation and moments. The topic of multiple random variables which consists of joint distribution and joint density along with conditional distribution and density will be discussed next. This topic will also include operations on multiple random variables. Finally, the topic on random process from the perspective of both the temporal and spectral domains will be given. This topic will cover wide sense stationary, ergodicity and independence, correlation functions, power density spectrum and cross-power density spectrum.

MEL 1233 Image Processing

This course introduces students to introductory and intermediate levels of image processing techniques. The area of coverage would be the digitization process as a mean to acquire the digital image. Next would be the enhancement and restoration processes which are to improve the quality of the image for next stage processing. Both the spatial domain and frequency domain approaches will be covered. The next stage would be the segmentation process. This is an important step towards advanced level processing. Another important topic that will also be discussed is the morphological processing. Wavelet transform and multiresolution analysis have been pivotal in many image processing applications and thus introduction to this area will be given. Finally the topic of compression and coding will be covered. MATLAB will be used extensively for better understanding.

MEL 1243 Software Engineering

Today, the computing power is supreme and a lot is expected of software system. Therefore, software engineering is even more important to produce quality product that is on time and within budget. This course is designed to make students understand the various issues that lead to the software crisis and the steps to solve the problems. This course attempts to cover a vast field covering all aspects of software development work from analysis, design, implementation, operation, maintenance, support, cost, management, and risk analysis. However, more focus will be given on software development process, programming, testing and maintenance since these are the fundamental aspect of software engineering. Special emphasis will be given to the process of object oriented design and programming as well as the use of UML in the design activities.

MEL 1283 Speech Processing

Speech Signal: Production, Perception and Acoustic – Phonetic characterization Signal Processing and Analysis method for speech processing, Pattern comparison technique, theory and Implementation of Hidden Markov Model. Speech recognition system design. Implementation issues.

Course Synopsis

Telecommunication – MET

MET 1313 Communication & Computer Networks

This course will enhance the students' knowledge on communication and computer network. It explains the basic concept of network layers, protocols, interfacing and inter-working between computer networks and network devices in telecommunication systems. The students will be taught with the various possible techniques to understand the modern networks for wired and wireless services.

MET 1323 Broadband Multimedia Networks

Digital Networks: network evolution, network synchronization, Pleisynchronous vs Synchronous Digital Hierarchy, SDH technology, Broadband ISDN/ATM; Broadband access networks: twisted pair, ADSL, XDSL series, Hybrid and Optical fiber; Digital switching: switching control and signaling, multimedia services and categories; Multimedia QoS requirements: delay, jitter, loss, multimedia streaming; Traffic

engineering: characterization, source model, arrival, departure and service process, state transition description, loss system, queuing system.

MET 1333 Optical Communications

The aim of this course is to introduce students to the theories, concepts and design of optical communication systems. The contents of this course focus towards the introduction to optical communication system and design of optical communication link. The first part covers optical fibers and passive components. This is then followed by optical sources and optical detectors. The next section covers the design and verification of fiber optic link. The course is concluded with highlight of recent advances in optical communications.

MET 1343 Coding of Multimedia Signal

This course is an introduction to the coding and processing of digital multimedia. The course covers current techniques for processing, storage and delivery of media such as audio, images, and video. This requires an in-depth understanding of digital signal processing for 1D signals, as well as the extensions to 2D and 3D cases. The emphasis will be on the theoretical basis as well as efficient implementations. Key components studied in details are digital filters, transforms, quantizers, bit allocators, entropy coders, motion estimation and compensation algorithms. Current and future audio/image/video compression standards and formats such as MP3, JPEG, JPEG2000, MPEG family, H.263, H.264...are frequently used as illustrations.

MET 1353 Multimedia Communication and System & Services

This course introduces the basics of multimedia communication systems and services. Students will be familiarized with the underlying theory, concepts and principles of multimedia communication system and the practicality in the current and future IP based network. The topics include the introduction to the concept of multimedia communication model and elements of multimedia communication systems. An overview of the recent trend in multimedia communication system development will be given. The students will be given a comprehensive understanding on multimedia processing in communication, distributed multimedia systems, multimedia communication standards and multimedia communications across networks. The emphasis will be on multimedia communication on next generation IP based network. Finally the students will be exposed with the various multimedia applications including VOIP, VOD, IPTV etc.

MET 1363 Secured Digital Communications

This course covers the basic principles and techniques used to protect information. The areas covered begins with description of the various communication systems in practice today, security architecture and models, issues related to legislation and ethics, and physical security. Then, the course will cover areas those are applicable to electronic and communication security with description of the various types of cipher systems followed by its use in authentication and finally in applications in telecommunication, network and the internet.

MET 1373 Sonar & Acoustic Engineering

This course introduces students to the fundamentals and characteristics of sound waves in solid, air and underwater. The students will be introduced to various acoustics concepts and criteria, and to design for a safe and optimum acoustics application in room and outdoor environment. Then the concept of sonar such as radiated power, projector, hydrophone, hydrophone arrays and its characteristics, and beams scattering and reflection. This topic will be extended to detail characteristics and operations of passive and active sonar.

MET 1383 Satellite Communication

This course introduces students to introductory and advanced level of satellite communication. In the beginning students will be introduced to the concept of satellite communication systems. Then the orbit mechanic concepts which include look angle and orbit determination. This topic will be extended to the satellite subsystems, link design and propagation effects. The topic of satellite system will

include VSATS, satellite broadcasting for TV and radio and Global Position System.

MET 1393 Network Modeling & Performance

This course develops the overview of network modelling using simulation and mathematical. Verification and validation are very essential in simulation analysis. This is emphasized and given in detail. Routing and congestion control are the key features in reducing congestion and upgrade performance in networks. Students will be introducing in detail of these algorithms.

MET 1413 Advanced Digital Communications

This course introduces topics in digital communications and provides a wide-range of methodologies used in digital communication systems. These include digital signal transmission and modulation in communication systems

MET 1423 Wireless Communications System

This course introduces students to introductory and advanced level of wireless communication. In the beginning students will be introduced to the concept of wireless communication systems. Then the cellular concepts which include frequency reuse and cell splitting. This topic will be extended to the interference issues, system capacity, trunking and grade of service. The topic of mobile propagation will include large scale and small scale mobile propagation follows by different multiple access techniques used in wireless communication systems. Finally different wireless systems and standards will also be covered.

MET 1433 RF/Microwave & Antenna Design

This course introduces students to concept and advanced level of RF /Microwave passive and antenna design In the beginning students will be introduced to the concept of transmission line and S Parameter in RF/ Microwave Engineering. The concept of smith chart will also be discussed. Then the design of each passive components such as matching network, coupler, divider and resonator will be introduced. The properties of the antenna will be introduced in the next section. The design of dipole, monopole and planar type of antenna will be discussed.

MET 1443 Electromagnetic Compatibility

To understand different electromagnetic Interference problems occurring in Intersystem and in inter system and their possible mitigation techniques in Electronic design.

MET 1453 Special Topic in Telecommunication Engineering

To be decided by the faculty

MET 1463 Advanced Communications Electronics

This course introduces students to concept and advanced level of RF communication electronics design In the beginning students will be introduced to the concept of transmitter and receiver in communications system. The design parameter for transmitter and receiver will be discussed**.** The effect of noise towards the design parameters. Then the design of each component will be introduced such as filters, amplifiers, oscillators and mixers.

MET 1473 Radar & Communication Based System

This course introduces students to radar principles and the basic radar communication systems. At the start, students will be introduced to the principles of radar technology and the basic scanning methods. Then radar targets and radar cross section (RCS) are introduced**,** followed by tracking, tracking errors, and tracking algorithm Next will be the radar transmitters and receivers. Components which are important for a radar system are discussed, which include radar antennas. Propagation of radio waves will be given an overview to emphasis the effects on a radar signal. This topic will be extended to radar clutters and interference. Then, the processing of radar signal signals is treated. Lastly, various radar communication systems will be described.

MET1483 Optical Network and Devices

This course is designed to expose the participants to aspects related to optical network. The course will commence with a brief introduction to the basic block of an optical network. It will then be followed by detail discussion on various passive and active optical components required to implement an optical network. Various aspect of multi-channel and long-haul optical network will be covered in the concluding section.

Course Synopsis

Power

MEP 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.

MEP 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 T-ω 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 modeling 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.

MEP 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, losses, simulation. 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: half bridge, full bridge, three-phase, harmonics and THD, square wave, PWM inverters, switching methods-bipolar, unipolar, harmonics elimination PWM, Space Vector modulation, advance inverter topologies. The focus is the design of power converters for specific applications such as utility, domestic appliance, electric vehicle and industrial applications.

MEP 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 SF_6 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.

MEP 1553 High Voltage Insulation & Coordination

This course provides an understanding of high voltage phenomena, and to present the concepts of high voltage insulation design together with the analytical and numerical tool available to high voltage equipment designers. The course introduces a number of topics related to conduction and breakdown phenomena, insulating materials and high voltage insulation. The first part of the course stresses on the phenomena of conduction and breakdown in gases, liquid and solid 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. The course also describes the design, performance, application and testing of outdoor insulators, which are the most critical components of transmission and distribution systems.

MEP 1563 Power Quality

This course introduces students to power quality aspect of electrical energy system. In the beginning students will be introduced to the overview of power quality phenomena. Then the concept of interruption will be given. Next, voltage sag will discussed in detailed which includes, voltage sag magnitude, duration phase angle jump, stochastic assessment and mitigation of interruption and voltage sag. Next is Harmonic followed by flicker and voltage unbalanced. Finally, the topic on power quality standards will be given.

MEP 1603 Power System Analysis & Computational Methods

This course introduces students to Advanced Power System Analysis. It reviews basic Power Network Concepts, Power Transmission Lines parameters and equivalent circuit models, Transformer and generator equivalent circuit models. The network is modelled using Bus admittance matrix formulation,. Using the power system network model, Power Flow analysis using Newton-Raphson Methods and The Decoupled Formulation is discussed, Fault Analysis and the application of symmetrical sequence components to unbalanced fault analysis is covered in this course. The course will also introduce basic concept of Stability, small swing angle and transient stability. Analysis of Swing curve and Multi-machine transient stability analysis will be covered in the course. The application of professional software to solve practical power system networks will be part of the course.

MEP 1613 Power System Control

The main course goal 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 of the course is to provide knowledge on the importance of the different systems, the functionality they provide, the data used and exchanged as well as development of these systems. At the conclusion of the course students should be able to design and simulate a typical power system and are studied with the help of MATLAB/SIMULINK or Power World simulation packages.

MEP 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.

MEP 1633 Power System Devices & Apparatus

This course introduces students to relevant apparatuses and devices in power system engineering. It will examine some key features and characteristics of the devices and their functions in the operation of power system.

MEP 1643 Lightning Protection and Grounding System

This course provides an understanding of lightning phenomena and earth performance under electrical stress due the discharge of lightning current as well as under ac current under normal and short-circuit condition. The related topics: 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 equipment damages and scheme of protection will be presented. This will follow with introduction to earthing systems: resistance value ; measurement of soil resistivity and earth resistance value, step potential, touch potential and transfer potential, soil characteristics under impulsive condition, transmission-line tower earthing installation, computer network earthing, design of AC substation earthing system.

MEP 1653 Integrated Resource Planning in Energy Sector

This course is designed to give an overview understanding of energy supply, demand, energy balance and sustainability. It covers the assessment of past, current and future energy systems; and provides the analytical framework and assessment methodologies needed to promote IRP in Malaysian contact.

MEP 1663 Special Topic in Power Engineering

To be decided by the faculty

MEP 1673 Power System Protection

Introduction to Power System Protection; Transducers:Current and Voltage transformers; Overcurrent Protection:IDMT Relay Setting, Rings and Interconnected System, Fault Philoshophy, Critical Path Method, Assessment of Protection System; Fuses, Reclosers and Sectionalisers, Distance Protection:Derivation of mho, off-set mho dan polarized mho characteristics, three stage distance protection, lenticular/quadrilateral characteristics. Differential Protection : Basic, Protection of Transformer, Line, Busbar; Protection of Industrial system, Industrial plant load shedding, Fault Diagnostic.

MEP 1683 Alternative Energy Technology Systems

This course provides in depth coverage of alternative energy technology (AET) systems that includes microturbines, fuel cells, photovoltaics, wind power etc. Emphasis will be placed on the energy flow, power management hybridization, power conversion and processing, storage, testing and integration. Various storage devices used incorporation with AET systems such as batteries, flywheels, capacitors and their associated power electronic converter topologies are discussed and compared. The course will also cover the design, simulation and the analysis of performance of some applications of AET systems that include applications in distributed generation, grid connected and rural electrification.

Course Synopsis

Mechatronics and Control

MEM 1713 Artificial Intelligence

This course offers insights to the students into understanding two techniques of artificial intelligence (AI), namely, fuzzy logic and neural networks. Both techniques have been successfully applied by many industries in consumer products and industrial systems. Fuzzy logic offers flexibility in developing rule-based systems using natural language type of rules. Neural networks on the other hand, have strong generalization and discriminant properties and offer a simple way of developing system models and function approximation. They are highly applicable for many pattern recognition applications. This course offers basic understanding of these two AI techniques and their applications in the real world. The course also includes hands-on experiments and programming of fuzzy logic and neural networks concepts.

MEM 1723 Advanced Process Control

The advanced process control course deals with the implementation of the feedback and feedforward control strategies in single and multiloop systems. The course begin with the modelling of the plant using the mathematical model and an empirical model. The PID controller is used in the feedback control strategy. In enhancing performance of the system, the feedforward, cascade and inferential control are utilized. And the end of the course, the multivariable variable control is introduced to reflect a real process control in the plant.

MEM 1733 Adaptive & Self-Tuning Control

This course introduces the students to adaptive and self-tuning control. The students will firstly learn the real-time parameter estimation technique, which will provide them with the key concepts required to understand many aspects of adaptive and self-tuning control. The students will then be exposed to the main techniques in Self-Tuning Control (STC), in particular the Pole Assignment and Minimum Variance Control. For the adaptive control, the students will be exploring the Model Reference Adaptive Control (MRAC) design using Gradient Approach/MIT Rule, Lyapunov and Hyperstability methods. Finally, some practical issues on implementation, applications and perspectives of adaptive and self-tuning control will be discussed.

MEM 1743 Modeling & Simulation of Dynamical Systems

This course focuses on modeling and simulation of dynamic systems. The course covers techniques for modeling of various physical systems such as mechanical, electrical and process control systems. Solution and analysis of control system response based on time and frequency responses will be taught. Numerical solution techniques of differential equations using Euler's method and Runge-Kutta are introduced. Finally, several aspects for development of simulation models using Matlab are discussed. Several case studies and an actual system will be used to enhance the student understanding.

MEM 1753 Advanced Instrumentation & Measurement

This course is an introduction to the advanced instrumentation and measurement The course covers current techniques for sensing technology and interfacing. Also, applications at a higher hierarchical level are included, such as self-testing, auto calibration, data evaluation and identification.. Key components studied in details are a review of powerful measurement techniques and basic principles and typical problems of sensor elements, detailed up-to-date reviews of the features of temperature sensors, displacement sensors,

flow sensors, level sensors, position sensors, motion sensors, biometrics and special topic in Flow Measurement Techniques use Process Tomography applications. Numerous case studies and problems set for each of the sensor application such as Optical Tomography / Ultrasounic Tomography, Electrical Capacitance Tomography/ dual Modality, Application in Column Scaning Testing

MEM 1763 System Identification & Parameter Estimation

This course is an introduction to the system identification and parameter estimation. The course covers an introduction to system identification, acquiring and pre-processing data, nonparametric model estimation methods, parametric model estimation methods, partially known estimation methods, model estimation methods in closed loop systems, recursive model estimation methods, analyzing, validating, and converting models and system identification case study. This requires an in-depth understanding of control system engineering, modern control system and digital control system. The emphasis will be on the theoretical basis as well as practical implementations. Key components studied in details are time response analysis, frequency response analysis, correlation analysis, power spectrum density analysis, model structure, parametric model, parameter estimation method, test signals and model validation methods.

MEM 1773 Multivariable & Optimal Control Systems

This course introduces students to concepts of multivariable and optimal control systems. Topics covered include: stability, observability and controllability of multivariable systems, multiloop control, dynamic matrix control, constraint control, centralized multivariable control, basic optimization concepts, linear quadratic regulator (LQR) systems, continuous and discrete time optimal control systems and constrained and unconstrained optimal control systems. The assignment for the course will be based on computer-aided (MATLAB®) design problems.

MEM 1783 Nonlinear and Robust & Control Systems

This course covers the analysis and design of nonlinear control systems using Lyapunov theory. The contents of the course include properties of solutions of nonlinear dynamical systems (with special emphasis on planar systems), Lyapunov stability analysis techniques, effects of perturbations, input-output stability, feedback linearization, controllability, observability, and nonlinear control design tools for stabilization.

MEM 1823 Advanced Robotics

This is a graduate level course on robotic systems. The course covers various advanced control techniques for controlling robot manipulator systems. This requires an in-depth understanding of stability analysis methods based on Lyapunov stability theory, mathematical modeling of complete robot manipulator dynamic model inclusive of actuators dynamics and various advanced control concepts developed for the control of robot manipulators. The emphasis will be on the theoretical basis as well as efficient implementations and design. Key components studied in details are stability analysis method using Lyapunov second method for nonlinear systems, integrated robot modeling based on state-space method, various advanced controller design for robot manipulator control based on centralized and decentralized approaches.

MEM 1833 Linear System Theory

This course is an introduction to the linear system theory. It is intended to be a fundamental course in graduate studies in control engineering field. Since it is a vast field, the discussion will be limited to the conventional approaches of state-space equations and the polynomial fraction method of transfer matrices.

MEM 1843 Advanced Digital Control

This is a level course on digital control systems. The course covers current techniques for analyzing and designing digital controllers for discrete-time and digital control systems. This requires an in-depth understanding of digital stability analysis methods and currents topics on digital controller design. The emphasis will be on the theoretical basis as well as efficient implementations. Key components studied in details are stability analysis method using classical and modern approaches for digital control systems, discrete-time and digital controller design using classical and state-space approaches, various advanced controller design for discrete-time and digital control system such as variable structure approach and adaptive model reference approaches.

MEM 1853 Discrete-time Systems & Computer Control

This course is an introduction to the discrete- time and digital control systems. The course covers the conversion of analog signals and system into their discrete and digital counterparts. The emphasis will be on the theoretical basis as well as efficient implementations. Key components studied in details are the sampling process and theorem, hold devices, the z-transforms and its applications, modeling of discrete-time systems using classical and modern approaches, time domain performance specifications for discrete-time system, practical realization of discrete-time and digital system transfer function in various form, and effects of quantization errors.

MEM 1863 Design of Microprocessor-Based Mechatronic Systems

This course covers the applications of microprocessor or microcontroller in mechtronics systems. Details of microcontroller architecture and its internal peripherals are covered. Design of interface to mechtaronics system utilizing the internal peripherals and programming of their operations using C language are emphasized.

MEM 1873 Real-Time Control System Design

This course covers the hardware and software aspects for real-time implementation of control system. Multi-tasking requirements and issues for real-time control are addressed. Case studies of different design and implementation techniques will be used to enchanced students understanding of the course.

MEM 1883 Autonomous Mobile Robotics

This course gives the students an in-depth treatment of main aspects of autonomous mobile robotics namely mechanism & locomotion, intelligence in mobile robotics and sensor fusion for autonomous decision making capability. The course delivery is not limited to lectures, tutorials only but as well personal reading, research based assignments on frontier knowledge materials and actual Doctoral experimental research carried out in UTM's mobile robotics laboratory. This course blends knowledge derived in-house with actual physical world autonomous mobile robotics, hence providing the unique experimental learning geared towards carrying out research.

SUBJECT AND SEMESTER OFFERED for FULL TIME/PART TIME PROGRAM

Electronic

Subject Code	Subject	Semester 1	Semester 2
MEL 1113	Nanoelectronic Devices		*
MEL 1123	Advanced Microprocessor Systems	*	
MEL 1133	Integrated Circuit Testing		*
MEL 1143	Advanced Digital Signal Processing	*	
MEL 1153	CAD for Electronics Design		*
MEL 1163	VLSI Circuit and Design		*
MEL 1173	Advanced Digital System Design		*
MEL 1183	Advanced Computer Architecture	*	
MEL 1193	Analog CMOS Design	*	
MEL 1223	Random Process		*
MEL 1233	Advanced Image Processing	*	
MEL 1243	Software Engineering		*
MEL 1283	Speech Processing		*
MEL 1263	Special Topic in Electronics Eng.	*	

Telecommunication

Subject code	Subject	Semester 1	Semester 2
MET 1313	Comm. & Computer Network	*	
MET 1323	Broadband and Multimedia Network	*	
MET 1333	Optical Communication	*	
MET 1343	Coding of multimedia signal	*	
MET 1353	Multimedia Comm. Sys and Services		*
MET 1363	Secured Digital Communications	*	
MET 1373	Sonar and Acoustic Engineering	*	
MET 1383	Satellite Communication		*
MET 1393	Network Modeling & Performance	*	
MET 1413	Advanced Digital Communication		*
MET 1423	Wireless Communication systems	*	
MET 1433	RF/Microwave & Antenna Design		*
MET 1443	Electromagnetic Compatibility	*	
MET 1453	Special Topic in Telecommunication Eng		*
MET 1463	Advanced Communication Electronics		*
MET 1473	Radar & Communication Based System		*
MET 1483	Optical Network and Devices		*
MET 1910	Master Research Dissertation	*	

POWER

Subject Code	Subject	Semester 1	Semester 2
MEP 1513	Electronic Power Conversion	*	
MEP 1523	Electrical Drives		*
MEP 1533	Power Electronic System	*	
MEP 1543	Advanced High Voltage Technology	*	
MEP 1553	High Voltage Insulation		*
MEP 1563	Power Quality		*
MEP 1603	Power Sys. Analysis & Computational Methods		*
MEP 1613	Power System Control	*	
MEP 1623	Power Trans. & Security		*
MEP 1633	Power System Devices and Apparatus	*	
MEP 1643	Lightning Protection & Grounding System		*
MEP 1653	Int. Resource Planning in Energy Sector	*	
MEP 1663	Special Topic in Power Engineering		*
MEP 1673	Power System Protection		*
MEP 1683	Alternative Energy Technology System	*	

Mechatronic and Control

Subject code	Subject	Semester 1	Semester 2
MEM 1713	Artificial Intelligence		*
MEM 1723	Advanced Process Control	*	
MEM 1733	Adaptive & Self Tuning Control		*
MEM 1743	Modeling & Simulation of Dynamical Systems	*	
MEM 1753	Advanced Instrumentation & Measurement		*
MEM 1763	System Identification & Estimation	*	
MEM 1773	Multivariable & Optimal Control Systems		*
MEM 1783	Nonlinear & Robust Control Systems		*
MEM 1823	Advanced Robotics	*	
MEM 1833	Linear System Theory	*	
MEM 1843	Advanced Digital Control		*
MEM 1853	Discrete-time Systems & Computer Control	*	
MEM 1863	Design of Microprocessor-Based Mechatronic Systems	*	
MEM 1873	Real-Time Control System Design		*
MEM 1883	Autonomous Mobile Robotics		*
MEM 1893	Special Topic on Control		*

PROJECTS/RESEARCH TOPICS OF INTEREST

* Note: This list is not an exhaustive list.

Electrical Power Engineering

- Gas-insulated switchgear (GIS) power system.
- Corona and electrical discharges.
- Performance of power system apparatus under lightning & switching surges.
- Effects of transients on telecommunication equipment and other protective devices.
- New insulating materials such as polypropylene fiber, composite and gas mixtures.
- High voltage testing and Insulation co-ordination and diagnostics.
- Fast transient response of zinc oxide surge arresters.
- Application of Neural Network & Fuzzy Logic to Power system
- Integrated Protection Engineering and Management Using AI
- Design and analysis of Demand Side Management
- High Performance Uninterruptible Power Supply (UPS).
- Development of Solar / Electric / Hybrid powered Vehicles.
- Power conditioner for Fuel cell power system application.
- Application of Solar Photovoltaic Systems.
- Rapid and Intelligent Battery Chargers for Electric vehicle and rechargeable batteries
- DSP and FPGA based Controllers for Power Electronics application
- Microcomputer implementation of a controller on a micro-alternator set
- Loss minimization in power system
- Power system harmonics - measurement, penetration and prediction
- Short-term load forecasting
- FACTS transmission system

Electronics & Computer Engineering

- Microelectronics devices and technology
- Low voltage IC test techniques
- Embedded System Design
- System-on-Chip (SoC) Technology
- ASIC design and System Level Design
- CAD techniques and tool development
- JAVA technologies
- Encryption processors & Cryptosystems
- Neural Network applications & Neurohardware
- Fuzzy Expert System hardware
- Multimedia Networking design & hardware
- Network troubleshooting & performance analysis
- Internet and Web technology
- Smartcard technology
- Micro processing and microcontrollers
- Speech Recognition & Synthesis
- Multimedia signal encoding & data compression
- Analysis & Classification of Heart Sounds
- Spread spectrum & military communication
- Image analysis & Computer Vision
- Real-time Wavelet Analysis
- Lasers and optical devices
- Speech therapy in rehabilitation of the handicapped
- Computer-based training system
- Computer-aided Rehabilitation Engineering
- Biomedical Imaging
- Medical instrumentation & Telemedicine

Communications Engineering

- Design of RF/microwave devices
- Digital modulation techniques
- IMT2000 applications
- Interference problems
- Microwave power transmission
- Mobile radio propagation
- Active printed antenna designs using metals and superconductors
- Broadband antenna design
- Rain attenuation studies in tropical regions
- Antennas & Microware circuits
- Terrestrial, mobile and satellite communications
- Bluetooth, Broadband Mobile Application
- Switching Technology
- Network Security & Internet Applications
- CDMA multi-user detection
- Network Performance Study
- Teletraffic Engineering
- Mobility Management in Wireless Network
- ATM Network
- Integration of Wireless and Fixed LAN
- MEMS
- Radio Optical Communication
- Photonic Switching
- Optical Access Network
- Optical Devices
- Unguided Optical Systems
- Acoustics engineering
- Acoustic material development
- Sound modeling of enclosed room
- Active Integrated Antenna Design
- Wideband Antenna design

Control Engineering

- Computer Control Systems
- Design of embedded systems
- Real-time Software Engineering for Mechatronics systems
- Design of robots and robotics work cells
- Application of advanced control in robotics
- Multi-agent intelligent mobile robots
- Internet-based telerobotics
- Industrial automation and computer integrated manufacturing
- Advanced Control strategies in Industrial Processes
- Identification and Control of Industrial Processes
- Intelligent Plant Interface
- Advanced Transducer Application
- Sensor technology
- Process Tomography for flow measurement
- Vision Systems
- Neural Network, Fuzzy Logic and Genetic Algorithms
- Intelligent Control Systems
- Artificial Intelligence applications
- Robust Control and Uncertain System

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Power System Analysis, Planning & Design, Power System Protection, Power Quality Embedded Generation, HVDC System, FACTS, Arcing Fault Prediction in Underground Cable.

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Lightning protection, grounding, surge suppression, power system insulation contamination, EMC, EMI

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AC motor control, utility application, high voltage equipment, power electronic converters, power electronic simulations.

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Power system Economics (Transmission Principle Engineering)Electricity Industry, Energy management

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Deregulated Power system, Large scale power system simulation

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Power system Economics (*Electricity Industry, Energy Management*)

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Electrical discharge, bio-plasma,ozone technology, ozone therapy

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Power quality, power system analysis, Deregulated power system.

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Robotics, Robust Control of Uncertain System, Large Scale Systems, Adv. robot control, Adaptive Control Techniques, Decentralized & Hierarchical Control.

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Flow measurement & instrumentation, Process Tomography, Advanced sensor application.

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Cooperative vehicle, Vehicle convey dynamic and control

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Acoustic Engineering, Noise control, Building acoustic

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Accelerated Simulation, Self Similar and Power Law Traffic, Wireless Sensor network and protocols.

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Wireless Broadband communications Systems, OFDM-based system, Space-time MIMO systems, Cognitive-radio networks

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Polymer Based Photonic Devices, Optical Devices Simulation, Fabrication and Characterization, Electromagnetic Field Theory

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RF and Microwave Engineering Antenna Design and Propagation studies

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Body antenna, Smart antenna, Antenna design

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