University of Moratuwa

Department of Electrical Engineering

M.Sc./P.G. Diploma Course in Electrical Engineering

The Department of Electrical Engineering conducts a postgraduate course leading to **M.Sc./P.G. Diploma in Electrical Engineering** in October each year, with the next course scheduled for October 2005. Only a limited number of places will be available to proceed to the MSc degree based primarily on the performance at the end of first year examination. The application forms are available on the Internet.

Details of the course is given below:

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Document 1: Eligibility Requirements

1.1 The degree of the **Bachelor of Science of Engineering** of **University of Moratuwa** in Electrical Engineering, Electronic and Telecommunication Engineering, Computer Science and Engineering or Mechanical Engineering.

OR

1.2 Any other **Engineering degree** of at least **four year** duration, in a relevant field of specialization, from a recognized university; the recognition of the university, the acceptability of the course, and the relevancy of the field to be judged by the Faculty and approved by the Senate of University of Moratuwa.

OR

1.3 Any other **Engineering degree** of at least **three year** duration from a recognized university, **AND** a minimum of **one year** of appropriate experience in a relevant field after obtaining such degree; the recognition of the university, the acceptability of the course, and the relevancy of the experience to be judged by the Faculty and approved by the Senate of University of Moratuwa.

OR

1.4 At least the **Associate Membership** (satisfying the educational requirements for Corporate Membership or similar graduate membership) of a recognised professional engineering institute in a relevant field **AND** a minimum of **one year** of appropriate experience after obtaining such membership; the acceptability of the Associate Membership status of the candidate, the recognition of the institute and the relevancy of the field for this purpose shall be judged by the Faculty and approved by the Senate of University of Moratuwa.

Document 2: Curriculum and Scheme of Evaluation

Curriculum of Postgraduate Course

Code	Course unit	Credits*	Evaluation (marks out of 100)	
			Written Exam	Assignments
Elective Courses				
EE 5022	Power Supplies and Applications	2.5	60±20	40±20
EE 5023	Resonant Converters	2.5	60±20	40±20
EE 5033	Power System Protection	1.5	60±20	40±20
EE 5034	Power System Reliability	2.5	60±20	40±20
EE 5037	Power Quality	2.5	60±20	40±20
EE 5052	Energy Economics	2.5	60±20	40±20
EE 5053	Energy Efficiency, Demand Management and Conservation	2.5	60±20	40±20
EE 5054	Energy Planning	2.5	60±20	40±20
EE 5055	Energy Pricing	2.5	60±20	40±20
EE 5091	Micro Hydro Project Development	2.5	60±20	40±20
EE 5098	Seminar	2.5	-	100
EE 5099	Project (optional unit for PG Diploma)	10	-	100
EE 5199	Minor Project (alternate unit for PG Diploma)	6	-	100
EE 6099	Dissertation (compulsory for MSc)	25	100	-
Optional Courses				
EE 5011	DC Motor Drives	2.5	60±20	40±20
EE 5012	Induction Motor Drives	2.5	60±20	40±20
EE 5013	Induction Generators	2.5	60±20	40±20
EE 5014	Transient Analysis of Synchronous Generators	1.5	60±20	40±20
EE 5015	Transient Analysis of Symmetrical Three Phase Induction Motors	2.5	60±20	40±20
EE 5016	Vector Controlled Induction Motor Drives	2.5	60±20	40±20
EE 5017	Permanent Magnet Motors and Actuators	1.5	60±20	40±20
EE 5018	Robust Control of d.c. Servomotors	2.5	60±20	40±20
EE 5021	Power Switching Devices	2.5	60±20	40±20
EE 5024	Pulse Width Modulated Voltage Source Inverters	2.5	60±20	40±20
EE 5025	Current Source and Load Commutation Inverters	1.5	60±20	40±20
EE 5026	Thyristor Inverters and Choppers	1.5	60±20	40±20
EE 5027	Voltage Regulator and Static Switches	2.5	60±20	40±20
EE 5028	Power Electronic Converter Harmonics	2.5	60±20	40±20
EE 5031	Demand Forecasting	1.5	60±20	40±20

EE 5032	Power System Operation	2.5	60±20	40±20
EE 5035	Power System Planning	2.5	60±20	40±20
EE 5036	Power System Stability	2.5	60±20	40±20
EE 5038	Hydro thermal co-ordination	2.5	60±20	40±20
EE 5039	HVDC Transmission	1.5	60±20	40±20
EE 5041	Digital Simulation of Electrical Transients	1.5	60±20	40±20
EE 5042	Surge Propagation in Multiconductor Lines	1.5	60±20	40±20
EE 5043	Analysis of Linear Network Systems	1.5	60±20	40±20
EE 5051	World-wide Energy Development	2.5	60±20	40±20
EE 5056	New, Renewable and Rural Energy Systems	1.5	60±20	40±20
EE 5057	Energy and the Environment	1.5	60±20	40±20
EE 5058	Energy Storage	1.5	60±20	40±20
EE 5059	Nuclear Power Plants	1.5	60±20	40±20
EE 5061	State Space Design	2.5	60±20	40±20
EE 5062	Digital Control	2.5	60±20	40±20
EE 5063	Hardware and Software for On-line Control	2.5	60±20	40±20
EE 5071	Microprocessor Based Systems	2.5	60±20	40±20
EE 5072	AI for Industry	2.5	60±20	40±20
EE 5073	Computer Networks	2.5	60±20	40±20
EE 5074	Internet Applications	1.5	60±20	40±20
EE 5081	Operations Research	2.5	60±20	40±20
EE 5082	Numerical Methods	2.5	60±20	40±20
EE 5083	Probability and Statistics	1.5	60±20	40±20
EE 5084	System Identification and Modelling	1.5	60±20	40±20
EE 5085	Stochastic Processes	1.5	60±20	40±20
EE 5092	Rural Electrification	1.5	60±20	40±20
EE 5093	Transformer Loading and its Economics	1.5	60±20	40±20

[1] 1 credit corresponds to 14 hours of lectures or equivalent

[2] The mean value in the evaluation scheme is the default value. It can be changed by the Lecturer/Examiner concerned, within the specified range, by announcement to the students at the commencement of the course unit.

Document 3: Syllabi of Course Units

3.1 EE 5011 - DC Motor Drives (2.5 credits):

Outline Syllabus: DC motor types and characteristics, Constant torque and power modes, Starting and braking, Half/full bridge single/three phase thyristor drives, Supply side distortion, Harmonic filters, Multiconverters, Reversible converters, Chopper controlled drives, Closed loop control.

3.2 EE 5012 - AC Motor Drives (2.5 credits):

Outline Syllabus: Characteristics of three phase induction and synchronous motors, Open loop and closed loop type classical V/f control, Control using six step and PWM inverters, Controlled starting and braking.

3.3 EE 5013 - Induction Generators (2.5 credits):

Outline Syllabus: Grid-connected induction generator (GCIG) and self-excited induction generator (SEIG), Induction generator applications, Dynamic models of induction machine based on space vectors, Dynamic and steady state modelling of induction generators driven by hydro-turbines, Behaviour of GCIG and SEIG in steady state and transient states.

3.4 EE 5014 - Transient Analysis of Synchronous Generators (1.5 credit):

Outline Syllabus: Transient modelling of synchronous machines, dq0 transformation, Simulation of synchronous machine transients, Modelling of turbine, speed governing and excitation systems, Simulation of faults and transient behaviour of the system.

3.5 EE 5015 -Transient Analysis of Symmetrical 3-Phase Induction Motors (2.5 credits):

Outline Syllabus: Reference frame theory, Voltage and torque equations, Conversion of machine equations to arbitrary reference frames, Transient model, Analysis of three phase faults, Linearized equations, Reduced order equations, Unbalanced operation.

3.6 EE 5016 – Vector Controlled AC Motor Drives (2.5 credits):

Outline Syllabus: Complex space vectors, Voltage and torque vector equations, Principle of field orientation, Estimation of rotor flux vector, Implementation of direct and indirect field oriented control schemes.

3.7 EE 5017 – Permanent Magnet Motors and Actuators (1.5 credit):

Outline Syllabus: Types and characteristics of high-energy permanent magnet materials, Design principles of PM actuators, PM dc motors, PM synchronous motors, Buried and surface mounted types, PM steppers and linear actuators, Safety with PM handling, Magnetizers.

3.8 EE 5018 – Robust Control of dc Servomotors (2.5 credits):

Outline Syllabus: Overview of classical control, Features of robust control, Adaptive control schemes, Sliding mode control, Design and implementation of sliding mode control schemes.

3.9 EE 5021 - Power Switching Devices (2.5 credits):

Outline Syllabus: Features and limitations of power diodes, thyristors, GTOs, power BJTs, power MOSFETs, IGBTs and hybrid devices, Methods of switching, Switching aid circuits, Drive circuits, Driving bridge connected devices, Design of protection circuits against over-voltages, over-currents, transient voltage spikes and shoot through faults, Thermal design and heat sink selection, Transient overloading.

3.10 EE 5022 - Power Supplies and Applications (2.5 credits):

Outline Syllabus: DC power supplies using fly-back, half/full bridge and push-pull methods, Resonant and bi-directional power supplies, Un-interruptible ac power supplies (UPS), Switch-mode, resonant and bi-directional ac power supplies, Power factor conditioning, Transformers for power supplies, Ferro-resonance.

3.11 EE 5023 - Resonant Converters (2.5 credits):

Outline Syllabus: Series, parallel and hybrid load resonant dc-dc converters, Resonant inverters, Zero current switching (ZCS) converters, Zero voltage switching (ZVS) converters, Pseudo-resonant switching converters, Resonant dc link inverters, High frequency dc link converters.

3.12 EE 5024 - Pulse Width Modulated Voltage Source Inverters (2.5 credits):

Outline Syllabus: Square wave 180^0 & 120^0 modulation modes, PWM techniques, square wave, Sinusoidal, Regular sampled, Harmonic elimination, Current controlled types, Predictive and space vector PWM, Voltage and frequency control.

3.13 EE 5025 - Current Source and Load Commutation Inverters (1.5 credit):

Outline Syllabus: ASCI single phase and three phase inverters, Analysis of commutating circuits, Control of CSI drivers, Load commutated inverters.

3.14 EE 5026 - Thyristor Inverters and Choppers (1.5 credit):

Outline Syllabus: Thyristor commutation methods, McMurray inverters, McMurray-Bedford inverters, Reverse impressed voltage (RIV) and current impulse displacement (CID) choppers.

3.15 EE 5027 - Voltage Regulators and Static Switches (2.5 credits):

Outline Syllabus: DC voltage regulators using buck, boost, buck-boost and Cuk converters, AC voltage regulators; single-phase and 3-phase types, integral cycle control, cyclo-converter control, Static switches; single phase and 3-phase, reversing switches, bus transfers, dc switches, solid state relays.

3.16 EE 5028 – Power Electronic Converter harmonics (2.5 credits):

Outline Syllabus: Harmonic requirements, Harmonic reduction with double and autowound multipulse transformers, Interphase and current control transformers, Calculation of harmonics, Meeting harmonic standards, Practical applications.

3.17 EE 5031 - Demand Forecasting (1.5 credit):

Outline Syllabus: Forecasting needs for developing countries: Cost of under/over building: Principles of forecasting: Alternative forecasting techniques, time series, econometric and end-use models: Load forecasting: Load duration

3.18 EE 5032 – Power System Operation (2.5 credits):

Outline Syllabus: Unit commitment; thermal and hydro constraints, fuel constraints, spinning reserve, Solution methods, priority list methods, dynamic programming: Economic dispatch; Transmission losses, Lambda -iteration method, First and Second Order Gradient method, Base Point and Participation Factors.

3.19 EE 5033 - Power System Protection (1.5 credit):

Outline Syllabus: Elements of system protection, types of protective relays, monitoring system conditions, fault characteristics, generator protection, transformer protection, bus protection, motor protection, line protection, pilot protection, protection for system stability, testing and commissioning of protective schemes, power line carrier, fault investigation and analysis, introduction to static relaying, coordinating of protection devices, power supply for protection and control systems, supervisory control system (scada), inadvertent trips - cause and prevention, fault calculations and relay settings, testing techniques, programmable logic controllers.

3.20 EE 5034 - Power System Reliability (2.5 credits):

Outline Syllabus: Frequency balance approach for system reliability analysis; power system reliability analysis; discrete convolution method; basic concept of continuous distribution approximation; multi-area reliability analysis; decomposition approach; one area reliability connected to assisting area; simultaneous decomposition-simulation; Monte-Carlo simulation; application of Monte-Carlo simulation to multi-area reliability calculations; composite system reliability evaluation

3.21 EE 5035 - Power System Planning (2.5 credits):

Outline Syllabus: Planning in a competitive electricity industry: forward markets and the concept of coordinated pricing and planning. The role and implementation of regulation. Sustainability and the role of distributors; Review of practical approaches adopted internationally and in Sri Lanka. Relationship to overall energy planning: Dimensions of system planning; objectives, categories of analysis, complexities, utility development philosophies: Issues in planning generating systems; demand, technology options, economic evaluation, reliability, constraints: Review of economic concepts: Generation system costs; levelized costs of generation, Production Cost Analysis: Models for long-range electric system analysis.

3.22 EE 5036 – Power System Stability (2.5 credits):

Outline Syllabus: Fundamental concepts and physical aspects of small-signal stability, Transient stability, Sub-synchronous oscillations & voltage stability, Techniques available for stability analysis of small and large electric power systems, Presently available methods for improving stability of practical power systems, their limitations and methods to overcome them, Case studies using EMTDC/PSCAD.

3.23 EE 5037 - Power Quality (2.5 credits):

Learning Objectives: To be able to classify power quality disturbances, model, quantify and mitigate power quality issues in power systems.

Outline Syllabus: Introduction to power quality, Classification of power quality disturbances and introduction to their origin and effects, Distribution system network topologies and network component modeling, Linear and non linear load modeling, Long term voltage variations, Voltage unbalance and unbalance factor, Voltage sags, CBEMA curve (ITIC), Voltage fluctuations and lamp flicker, Transient due to capacitor switching, Harmonics and their effects, Harmonic standards, Power quality monitoring.

3.24 EE 5038 – Hydro thermal co-ordination (2.5 credits):

Outline Syllabus: Co-ordination between hydro generation resources and thermal generation in a hydro-thermal power system.

3.25 EE 5039 – HVDC Transmission (1.5 credit):

Outline Syllabus: Comparison of a.c and d.c transmission: advantages, inherent problems and economics, Converter arrangements and operation: control angle (delay angle), commutation angle (overlap angle), current waveforms, power factor, current waveforms on a.c. system, Inversion, Control characteristics: Natural Voltage Characteristic (NV) and the Constant Ignition Angle (CIA) control for rectifier operation, Constant Extinction Angle (CEA) control for inverter operation, Constant Current Control (CC), Full characteristic of converter, Compounding of converters, Per unit converter chart, Classification of d.c. links, Harmonics and filters.

3.26 EE 5041- Digital Simulation of Electrical Transients (1.5 credit):

Outline Syllabus: Tools for transient analysis, Digital transient simulations, Transform techniques, Travelling wave techniques, Piecewise linear representations, Frequency dependent line parameters, Electromagnetic transient programs, Problem solving using EMTDC.

3.27 EE 5042- Surge Propagation in Multiconductor Lines (1.5 credit):

Outline Syllabus: Modal theory, Reflection matrix approach, Two port matrix equations, Eigen values and eigen vectors of ZY product, Solution of multiconductor wave equation, System symmetry, Effect of earth wires, Natural modes of propagation, Three phase perfectly transposed line.

3.28 EE 5043 - Analysis of Linear Network Systems (1.5 credit):

Outline Syllabus: Matrix mesh and nodal analysis, Formulation of equations, Connection matrices, Networks with transformers, Diakoptical mesh and nodal analysis.

3.29 EE 5051 - World-wide Energy Development (2.5 credits):

Outline Syllabus: Primary sources of energy, their major reserves and depletion rates, World energy markets, pricing strategy and cartels, Energy supply and consumption in developed and developing countries; Energy consumption patterns; regional and sectoral, Energy sector in Sri Lanka, energy utilities and the regulatory process, Resources and supply patterns, Consumption patterns and sectoral consumption, World trends in regulatory and ownership reforms; Private participation in energy utilities, analysis of private power projects; utility and developer perspectives.

3.30 EE 5052 - Energy Economics (2.5 credits):

Outline Syllabus: Energy as a sector of a national economy; demand analysis; price and income elasticity of demand; self- and cross-price elasticities; identification of determinants of demand; demand forecasting using trend, time-series, econometric; end-use and hybrid techniques; judgmental methods; Typical issues in developed and developing countries. Economic comparison of supply-side energy options; economic and financial cost-benefit analysis of energy projects; analysis of demand-side options and substitution options.

3.31 EE 5053 - Energy Efficiency, Demand Management and Conservation (2.5 credits):

Learning Objectives: To be familiar with important issues related to energy policy. To be able to identify and quantify the typical energy management opportunities to perform energy assessments of industrial and commercial buildings, including determining data needs, utilizing instrumentation, and analysing and presenting results.
Outline Syllabus: Supply-side efficiency issues; power system loss optimization; efficiency issues in oil exploration and refining. Demand-side efficiency issues; efficiency/efficacy of typical end-use devices such as motors, lighting devices, air conditioning systems, transportation, boilers, furnaces, conventional and improved stoves; scope for improvement; recent development world-wide and in Sri Lanka. Energy auditing; energy systems in typical industrial and commercial buildings; how to conduct an energy audit; measurements and instrumentation; worked example of a preliminary energy audit in an industry; project identification and financial evaluation

3.32 EE 5054 - Energy Planning (2.5 credits):

Outline Syllabus: Development of an energy database; the national energy balance; development of a reference energy system. Integrated National Energy Planning; Energy sector policy analysis; strategic options; optimal energy mix; Integrated Resource Planning; Energy planning models; Planning models for power generating systems, transmission and distribution, planning models in the petroleum sector; discussion of their important algorithms; worked examples

3.33 EE 5055 - Energy Pricing (2.5 credits):

Outline Syllabus: Electricity Pricing; short-run and long-run marginal costing; pricing models and utility practice; typical electricity tariffs; calculations of demand charge and energy charge; development of tariffs; time-of-use and seasonal tariffs; conflicts between revenue requirement and marginal-cost pricing. Pricing of Electrical Services; pricing of non-utility generation; transfer prices; transmission and wheeling costs and pricing. Pricing of petroleum products; refinery gate prices; pricing for demand management; movement of prices in the world and regional markets

3.34 EE 5056 - New, Renewable and Rural Energy Systems (1.5 credit):

Outline Syllabus: Emerging technologies (wind, solar, wave, tidal, OTEC); their status of development and economics; design of a stand-alone renewable energy system; design of a hybrid system. Design and operation of grid-integrated renewable energy systems

3.35 EE 5057 - Energy and the Environment (1.5 credit):

Learning Objectives: To provide state-of-the-art education in the fields of energy utilization by means of economically and environmentally sustainable systems and technologies.

Outline Syllabus: Environmental impacts of energy systems; supply-side and demand-side impacts; mitigatory measures; environmental economics; analysis of environmental attributes an decision-making; environmental regulations in Sri Lanka, standards for contaminants and other guidelines

3.36 EE 5058 - Energy Storage (1.5 credit):

Outline Syllabus: Pump storage hydro, Battery banks, Superconducting magnetic energy storage, Compressed air storage, Relative merits and demerits.

3.37 EE 5059 - Nuclear Power Plants (1.5 credit):

Outline Syllabus: Nuclear fission and fusion energy release, Main components of Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR) and Pressurized Heavy Water Reactor (PHWR) plants, Safety systems, Reactor control..

3.38 EE 5061 - State Space Design (2.5 credits):

Outline Syllabus: Linear Systems theory, Concept of state, Linear differential equations, State transition matrix for linear time-invariant and time-variant systems, Controllability, Observability, Duality, Canonical forms, Input/output models, State feedback and modal control design, State observers and their design, Optimal controller design.

3.39 EE 5062 - Digital Control (2.5 credits):

Outline Syllabus: Basics of sampled data systems, Samplers, Data holds and digital compensators, The z-transform and extended z-transform. Block representation of sampled data feedback systems, Stability analysis via root locus and Nyquist plot techniques, Compensator design for deadbeat response.

3.40 EE 5063 - Hardware and Software for On-line Control (2.5 credits):

Outline Syllabus: Examples of computer controlled systems, Basic sampling theory, D/A and A/D conversion, Hardware components of data acquisition, Device interfacing, control registers, instruction set and assembler programming for DAQs, Concurrent programming for on-line control, real-time executives and applications, Distributed systems.

3.41 EE 5071 - Microprocessor Based Systems (2.5 credits):

Outline Syllabus: Uniprocessor, coprocessor and multiprocessor systems, RISC and CISC architectures**.** Digital Data Manipulation: Error codes, parity, Hamming code. Computer Organization and Control: Polling, interrupts, DMA, bus control, priority levels. Peripheral Devices and data communication standards: RS232, IEEE488, VME**.** Operating Systems and Memory Management: Virtual memory, compilers, linkers, interpreters, network operating systems.

3.42 EE 5072 - AI for Industry (2.5 credit):

Outline Syllabus: Introduction to artificial intelligence; expert systems and reasoning systems, Introduction to neural networks, Fuzzy logic, fuzzy systems, and their applications

3.43 EE 5073 - Computer Networks (2.5 credits):

Outline Syllabus: Communication networks; LANs, WANs, MANs, Internet, Intranets, protocols, layered architecture of networking; ethernet, token ring, token bus, X.25, Use of modems.

3.44 EE 5074 - Internet Applications (1.5 credit)

Outline Syllabus: Overview of the Internet, Browser, Client and Server.

Introductory-level overview of the technologies involved in building a web application. (No previous experience with web design or HTML is assumed.)

Creating a Web-page - Basic Document Structure. Hand coded HTML: tags and tag attributes, Lists, Images, Hyperlinks, Tables, Forms, Links and Anchors. Document Header, Meta tags. Frames. Class information, Style sheets. Authoring Tools. HTML Validation. Exercise: Creating an interactive web-page for ones-self.

3.45 EE 5081 - Operations Research (2.5 credits):

Learning Objectives: To enable graduates to play an effective role in providing decision support to managers

Outline Syllabus: Linear and dynamic programming, Sensitivity analysis, Network analysis, Integer programming.

3.46 EE 5082 - Numerical Methods (2.5 credits):

Outline Syllabus: Fast Fourier Transforms (FFT), Numerical methods for solving elliptic equations, Finite difference methods, Finite element methods and variational methods, Modal matrix analysis,

3.47 EE 5083 - Probability and Statistics (1.5 credit):

Outline Syllabus: Probability theory and statistical analysis, Data Analysis and probabilistic modelling, Correlation, Cospectrum, Single and Multivariate distributions, Linear and multiple regression

3.48 EE 5084 - System Identification and Modelling (1.5 credit):

Outline Syllabus: Deterministic modelling, Data analysis and sampling, Windowing, Parametric and non-parametric spectral analysis, Off-line system identification, On-line system identification, AR, ARX, ARMA, ARMAX modelling, Model order determination, Model validation, Prony signal and transfer function identification techniques.

3.49 EE 5085 - Stochastic Processes (1.5 credit):

Outline Syllabus: Classification of stochastic processes, Discrete-time Markov chains, Continuous-time Markov chains, Queues, Queuing disciplines and classifications, Analysis of simple queues, Little's law, Stochastic simulation, Generation of random numbers, Simulation algorithms, Statistical evaluation of output data.

3.50 EE 5086 - Project Management (1.5 credit):

Learning Objectives: To provide the necessary exposure to the application of the project management knowledge, skills, tools and techniques to meet or exceed stakeholder needs and expectations.

Outline Syllabus: Definition of Project Management and relationship to other management disciplines. Project Appraisal: Financial, technical, environmental etc. Project Management Context: Project phases and project life cycle, project strategy development, project stake holders. Organizational and socio-economic influence, key management skills, project initiation and modelling, project management process, project procurement management and project scheduling. Project cost estimation and control, project quality management, project risk management, project assessment and stakeholder marketing and case studies.

3.51 EE5087 - Human Resource Management (1.5 credit):

Learning Objectives: To appreciate the role of Human Resource Management in an organization and it's various facets and to evaluate HRM practices in organization.

Outline Syllabus: Human resources planning, Job Analysis and Job design, Recruitment & Selection, Training & Development, Managing Performance, Reward Management, Human Resource Information Systems, Strategic Human resource management, Managing Labour Relations.

3.52 EE 5091 Micro Hydro Project Development (1 credit):

Outline Syllabus: Preliminary studies, Hydrological studies and viability of the project, Feasibility studies and design, Financial and sensitivity analyses, Investor decisions and risk management, Involvement of government organizations, Project implementation, Facing contingency situations.

3.53 EE 5092 Rural Electrification (1 credit):

Outline Syllabus: Need for rural electrification, issues related to grid extension, stand-alone systems: Resource assessment, technology and problems of micro hydro, photovoltaic, biomass/biogas and wind systems, social and environmental aspects, policy issues, role of utilities in rural electrification.

3.54 EE5093 - Transformer Loading and its Economics (1.5 credit):

Learning Objectives: To be able to apply the factors affecting transformer loading and be able to select a transformer for the electrical installation in an economic manner.

Outline Syllabus: Selection of a distribution transformer rating, Economic evaluation, calculation criteria, capitalisation of losses, Harmonic effects on Transformers and Harmonic effect calculations, Calculation of Transformer De-rating factors, Case Studies and Design considerations for New Transformer Specification.

3.54 EE5098 - Seminar (2.5 credits):

Learning Objectives: To enhance communication abilities in students - critical reading, verbal communication and presentations skills. To develop the ability of students to do unsupervised work at graduate level.

Outline Syllabus: Critical reading of technical literature and summarising contents. Verbal communications and writing skill development. Adapting the speech and the written material for the intended audience. Making Seminar type presentations as a tool for interpersonal communication, projects presentation, public speaking, and report writing.

3.55 EE 5099 - Project (10 credits) [alternate to module EE5199 available for the PG Dip only]

Learning Objectives: To allow students to apply skills gained in the course to a related project. To gain the ability to learn and apply new ideas as needed to meet project goals.

Outline Syllabus: The student is expected to work individually to develop a given project at a greater depth than in EE5199 and may be allowed to be done in lieu of courses in special cases. They shall be carried out for a period of not less than three months, on a part time basis (or equivalent period full time) under the supervision of a senior staff member. All students must make a written and verbal presentation at the completion of the module.

3.56 EE 5199 - Minor Project (6 credits) [compulsory unless unit EE5099 is taken instead]:

Learning Objectives: To allow students to apply skills gained in the course to a related minor project. To gain the ability to learn and apply new ideas as needed to meet the minor project goals.

Outline Syllabus: The student is expected to work individually to develop a given minor project in a given time period. All students must make a written and verbal presentation at the completion of the course unit.

3.57 EE 6099 - Dissertation (25 credits)

Learning Objectives: To allow students to apply skills gained in the course to a multidisciplinary project. To develop specific skills in project definition, planning, and scheduling, effective written and oral communication of technical ideas. To incorporate realistic constraints and engineering standards.

Outline Syllabus: The student is expected to work individually on a research dissertation on a topic assigned or agreed by the Department. It is to be carried out for a period of not less than one academic year, on a part time basis (or equivalent period full time) under the supervision of a senior staff member and/or industrial supervisors. The student is expected to develop a complete plan from feasibility study, cost analysis, through electrical design and documentation to the building of a prototype or developing of a model as applicable. All students must make a formal written and verbal presentation to a panel.

Document 4: Performance Criteria

4a: For Postgraduate Diploma

4a.1 **Title of the Award :** Postgraduate Diploma in Electrical Engineering

4a.2 **Participation in Academic Program:**

1. The candidate is required to have attended at least 80% in lectures, tutorial classes, seminars and other components.
2. Undertake an individual project, as assigned by the Department, on a specific subject area.
3. No postponement of the course is allowed without the prior approval of the Senate.

4a.3 **Pass in the Postgraduate Examination:**

1. A candidate is deemed to have passed the Postgraduate Examination if the candidate has:

   (a) successfully completed the required course units, including compulsories, totalling a minimum of **40 credits** **AND**

   (b) successfully completed the prescribed seminars **AND**

   (c) successfully completed all the prescribed assignments, laboratory work, **AND**

   (d) successfully completed the prescribed project.

   Note: In order to be considered successful and earn credit for the course unit, the candidate must earn grade C or above. Where a course unit consists of more than one component (written examination, seminars, laboratory work, assignments etc) the pass mark for each component is 40%.

2. If the candidate is unsuccessful in any of the parts 1.(a) through 1.(d), he/she may be re-examined. Normally only one re-examination will be allowed and this shall be at the next holding of the examinations or assessments. No postponement shall be allowed without approval from the Senate.
3. Classes will not be awarded.

4a.4 **Credit Rating:** A credit is defined as one hour of Lectures per week for the duration of one Semester which will usually be of 14 weeks duration. A Credit will also be equivalent to about 2 hours of assignments per week for one semester.

4a.5 **Grading of Marks:** Performance of the candidate in each course unit shall be graded based on the following benchmarks:

Grade	Benchmark	Grade Point	Description
A+	>= 85%	4.2	
A	75% - 84%	4.0	Excellent
A-	70% - 74%	3.7	
B+	65% - 69%	3.3	
B	60% - 64%	3.0	Good
B-	55% - 59%	2.7	
C+	50% - 54%	2.3	Pass
C	50% - 54%	2.0	Pass (Repeat Candidate)
I		0	Incomplete
F		0	Fail
N		0	Academic Concession

A candidate who has not earned a grade of C+ or above in a particular course unit at the first attempt, but has obtained minimum marks for at least one component, receives the grade I otherwise he receives the grade F. By repeating the incomplete component for those obtaining the grade I, or all the components for those obtaining the grade F, the candidate can upgrade grade C only and this will be used for calculating the grade point average (GPA). The grade N signifies the academic concession granted with the approval of the Senate.

4a.6 **Calculation of Grade Point Average:** The overall grade point average (GPA) of the postgraduate examination will be calculated according to the following formula.

$$\text{Overall GPA} = \frac{\sum[\text{GradePoints} \times \text{Credits}]}{\sum \text{Credits}}$$

Note: All credits offered by the student, irrespective of whether completed or not will be considered in the evaluation of the Overall GPA.

4a.7 **Release of Result of Written Examination:** Performance of a candidate at the written examination shall be released after the Board of Examiners meeting, subject to confirmation of the Senate, unless the Board of Examiners recommends withholding of the results for specific reasons.

4a.8 **Criteria for the Award of the Postgraduate Diploma:**

1. Passed the Postgraduate Examination as specified in clause ***4a.3***

   AND

   Not desirous of proceeding to the Master's dissertation, either before commencement or thereafter, as indicated in writing to the head of department **OR** Not able to undertake/complete the Master's dissertation under the prescribed conditions.

4a.9 **Date of Award:** The effective date of the Postgraduate Diploma shall be the first day of the following month after the successful completion of all of the following components of the postgraduate examination:

1. written examinations
2. seminars
3. assignments and laboratory work and projects

4b: Performance Criteria for Master of Science Degree

4b.1 Title of the Award : Master of Science - Specialisation Electrical Engineering

4b.2 Participation in Academic Program:

1. Passed the postgraduate examination as specified in clause ***4a.3*** but has not been awarded the Postgraduate Diploma
2. Has obtained an overall GPA of at east 3.0 at the postgraduate examination.
3. Undertake an individual research dissertation, as assigned by the Department, on a specific subject area, for a period of not less than one academic year duration on a part time basis or equivalent.
4. the postponement of the dissertation will only be allowed with prior approval from the Senate.

4b.3 Pass in the Dissertation:

1. The candidate will be graded based on the evaluation of the final seminar and oral examination by a panel of examiners.
2. The grading of the dissertation is directly on a letter Grade. The benchmark performance given in clause ***4a.5*** may be used for guidance.
3. A candidate is deemed to have passed the dissertation, if the candidate earns the Grade C+ or above at the first attempt.
4. If the candidate is unsuccessful in dissertation, he/she may be re-examined and given the pass grade C if successful. Normally only one re-examination will be allowed, usually after a minimum of three months but not exceeding 12 months after the initial examination/assessment.

4b.4 Criteria for the Award of the M.Sc. Degree:

1. Passed the Postgraduate Examination as specified in clause ***4a.3***

   AND
2. Successfully completed any additional prescribed seminars and assignments

   AND
3. Successfully completed the research dissertation assigned to the candidate.

4b.5 Date of Award:

The effective date of the MSc degree shall be the first day of the following month after the successful completion and evaluation of all of the following components:

1. Postgraduate Examination as specified in clause ***4a.3***
2. Research dissertation
3. Submission of final bound copies of dissertation (after corrections if any).

Document 5: Awards

The **Lanka Transformers Ltd Award** is awarded to the MSc Graduand specialising in Electrical Engineering who has obtained the highest weighted GPA of not less than 3.70, calculated based on 80% of postgraduate examination GPA and 20% of dissertation grade-point, and completes the M Sc degree in the minimum time.

Document 6: Resource Persons

Course Co-ordinator: Dr Lanka Udawatta

Head of Department: Prof. H Y Ranjit Perera

Lecturers:

Department of Electrical Engineering:

1. Prof. J.R. Lucas (Senior Professor)
2. Prof. H.Y.R. Perera (Professor)
3. Prof. P.D.C. Wijayatunga (Professor)
4. Dr. M.P. Dias (Associate Professor)
5. Dr. J.P. Karunadasa (Senior Lecturer Gr. I)
6. Dr. D.P.N. Nanayakkara (Senior Lecturer Gr. II)
7. Dr. N.K. Wickramarachchi (Senior Lecturer Gr. II)
8. Dr. U.K.D.L.P. Udawatta (Senior Lecturer Gr. II)

University of Moratuwa:

1. Prof. R.A. Attalage, (Professor, Department of Mechanical Engineering)
2. Dr. G.T.F. de Silva, (formerly Associate Professor, Department of Mathematics)
3. Dr. M. Indralingam, (Senior Lecturer, Department of Mathematics)
4. Dr. D.P.T. Nanayakkara (Senior Lecturer, Department of Mechanical Engineering)
5. Dr. S. Witharana (Senior Lecturer, Department of Mechanical Engineering)
6. Dr. T. Sugathapala (Senior Lecturer, Department of Mechanical Engineering)
7. Dr. C. R. de Silva (Senior Lecturer, Department of Computer Science & Engineering)
8. Mr. Shantha Fernando (Senior Lecturer, Department of Computer Science & Engineering)
9. Mr. M. Firdhous, (Senior Lecturer, Faculty of Information Technology)

Visiting Staff:

1. Prof. H. Sriyananda, BScEng(Ceylon), MSc(Salford), Phd(Wales)
   Senior Professor of Electrical Engineering, Open University of Sri Lanka
2. Dr. L. S. Wickramaratne, BScEng (Moratuwa), PhD
   Head, Department of Electrical & Computer Science, University of Ruhuna
3. Dr. T. Siyambalapitiya, BScEng (Moratuwa), PhD (Cambridge)
   Independent Consultant/Former Chief Engineer, Generation Planning, CEB
4. Dr. B.L.P.P. Perera, BScEng (Moratuwa), PhD (London), DIC
   Investment Officer, International Finance Corporation (IFC)
5. Mr. W.J.L.S. Fernando, BScEng (Moratuwa), MEng (AIT)
   DGM, Generation Planning, CEB
6. Mr. S. Dias,
   Senior Lecturer, Department of Mathematics, University of Sri Jayawardenapura