EEX3410 Introduction to Electrical Engineering

Level	3
Course Code	EEX3410
Course Title	Introduction to Electrical Engineering
Credit value	4
Core/Optional	Core
Course Aim/s	Aim of this course is to provide basic principles of Electrical Engineering and its applications
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Perform analysis of simple capacitor circuits computing electrostatic interactions. CLO2: Describe basic circuit theories of electricity by using first order passive circuits. CLO3: Analyse DC and AC circuits using the basic circuit theories. CLO4: Analyse linear magnetic and electro-magnetic circuits using basic magnetic circuit theories. CLO5: Describe the operating principles of electrical machines using electro-magnetic principles. CLO6: Describe generation and transmission of electric energy and the safe & efficient use in the household. CLO7: Describe characteristics of ideal and real semiconductor diodes and its applications. CLO8: Describe the use of basic transistor circuits for amplification and switching. CLO9: Perform laboratory experiments accurately and safely using appropriate measuring instruments.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Electrostatics Session 01: Introduction to Electrostatics Session 02: Electric Flux & Electric Potential Session 03: Capacitors Unit 2: DC Circuits Session 04:Voltage-Current relationship in DC circuits Session 05:Kirchhoff's Laws Session 06:Circuit Theories Unit 3: Electromagnetism Session 07:Introduction to Magnetism Session 08:Magnetic Flux Session 09:Effects of Magnetic Flux Session 10:Magnetic circuits Session 11:Electromagnetic Induction Session 12:Transients in DC circuits Unit 4: AC Circuits Session 13:Fundamentals of Waveforms Session 14:Voltage-Current relationship in AC circuits Session 15:RLC circuit calculations Session 16:Power in AC circuits Unit 5: Electrical Machines Session 17:Basics of Rotating Machines Session 18:Transformers Unit 6: Electrical Measurements Session 19:Principles of Measuring Instruments Session 20:Operating Measuring Instruments

	Unit 7: Electrical Power Generation & Transmission Session 21:Generation of Electrical Power Session 22:Transport of Electric Energy Unit 8: 3-phase Systems Session 23:Introduction to Three-phase Systems Session 24:Three-phase Power Unit 9: lectrical Installations Session 25:Electrical Safety Session 26:Domestic Wiring Unit 10: Electronics Session 27:Semiconductor Diode Session 28:Diode circuits Session 29:Transistors Session 30:Transistor applications
	Laboratory work: Three experiments are conducted during 6 sessions – 3 days 1. Verification of Kirchchoff law for DC circuits 2. Measure the fundamental characteristics of AC signals using oscilloscope 3. Verification of characteristics of non-linear components

EEX4332 Electrical power

Level	4
Course Code	EEX4332
Course Title	Electrical power
Credit value	3
Core/Optional	Core (Computer, Electronic and communications,)
Course Aim/s	To provide basic knowledge of power distribution and utilization of electrical power, including economical consideration.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Identify and explain the techno-economical issues related to generation, transmission and distribution of electrical power and its utilization. CLO2: Apply electrical engineering knowledge to gain fundamental understanding of electrical installations and associated electrical wiring regulations. CLO3: Apply safety measures in handling electricity. CLO4: Describe the different categories of electrical machines, their principles of operation, the underlying electromagnetic principles and applications. CLO5: Explain basic operations of AC and DC electrical machines. CLO6: Compute thermal and electrical ratings of motors under normal and specified operating environments.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: General aspects of electrical engineering Session 1: Technical factors affecting economics of electricity supply Session 2: Electricity tariffs and the economy of power factor improvements Session 3: Practical aspects of electric power utilization Session 4: Distribution networks Unit 2: Electrical Installations Session 5: Introduction to electrical installation and IEE wiring regulations Session 6: Fundamental requirements for safety Session 7: Electrical protection Unit 3: Electrical Machines Session 8: Introduction to transformers Session 9: Practical transformers Session 10: Auto transformers and instrument transformers Session 11: Introduction to electrical machines Session 12: The single-phase induction motor Session 13: The three phase induction motors Session 14: DC machine theory Session 15: DC motors and generators Session 16: Introduction to special purpose motors and drives Session 17: Introduction to synchronous machines Unit 4: Operational aspects of electrical machines Session 18: Thermal rating of electrical machines Session 19: Operational aspects of electric motors Session 20: Power system harmonics Session 21: Energy storage devices

	Laboratory work: 1. Perform open circuit test and short circuit test on a single phase transformer 2. Determine transformer performance parameters 3. Determine characteristics of fuses and MCBs 4. Correction of power factor in AC circuits 5. Measurement of power and energy 6. Determine characteristics of plain compound DC motor 7. Determine characteristics of three-phase induction motor

EEX4434 Electrical Installations

Level	4
Course Code	EEX4434
Course Title	Electrical Installations
Credit value	4
Core/Optional	Core (Electrical)
Course Aim/s	To provide knowledge of designing domestic and commercial electrical installations by explaining procedures as per the local and international rules and regulations. To provide knowledge of lighting and illumination principles and design.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Define terms and identify symbols used in the IEE Wiring Regulations and recognizing the general characteristics of an electrical installation. CLO2: Describe the structure of prevailing IEE Wiring Regulations and state its application when designing. CLO3: Illustrate the characteristics of various types of protective devices used in electrical Installations. CLO4: Select the correct type and size of an electrical cable suitable for an electrical circuit under given environmental conditions. CLO5: Select suitable earthing system for an electrical installation by considering safety and protection concerns. CLO6: Evaluate earth resistance for various earthing electrode configurations. CLO7: Design a wiring system for a two-story domestic installation by providing a comprehensive technical report in accordance with the IEE/local regulations and service provider. CLO8: Demonstrate testing and energizing of a typical domestic electrical installation. CLO9: Describe lighting terminology with the help of laws of illumination, characteristics of different types of lamps and lighting schemes and their applications. CLO10: Perform step by step approach of Lumen method for lighting design by Estimating utilization factors.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Installation & Design I Session 1: Introduction Session 2: The wiring regulations Session 3: Scope, object and fundamental principles Session 4: Assessment of general characteristics Session 5: Electric shock Session 6: Requirement for basic protection (Protection against direct contact) Session 7: Requirement for fault protection (Protection against indirect contact) Session 8: Selection of protective devices against indirect contact Session 9: Protection against thermal effects Session 10: Protection devices against over currents Unit 2: Installation & Design II Session 11: Overload Protection Session 12: Short Circuit Protection Session 13: Discrimination of Protective Devices Session 14: Protective Conductors Session 15: Protective Conductors size Session 16: Earth Electrode Impedance Session 17: Earth Resistivity measurements Session 18: Current Rating of a cable Session 19: Calculation of Cable rating-I

	Session 20: Calculation of Cable Rating-II Session 21: Capacity of Conduit and Trunking Session 22: Maximum Demand and Diversity Session 23: Application of Diversity Session 24: Inspection and Testing Unit 3: Lighting Session 25: Lighting terminology and Laws of Illumination Session 26: Lighting schemes and components Session 27: Lighting Design
	Design project **1.** Design electrical wiring (connection of accessories) for a typical domestic electrical Installation **2.** Demonstrate inspection and testing procedures using appropriate instruments before energizing a domestic electrical installation (Laboratory model)

EEX4448 Electrical Machines

Level	4
Course Code	EEX4448
Course Title	Electrical Machines
Credit value	4
Core/Optional	Core (Electrical)
Course Aim/s	To provide knowledge of AC and DC machine theory with their constructional features and operating principles.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Describe the principle of energy conversion in different types of electrical machines. CLO2: Describe the operating principle, constructional features and characteristics of single phase and three phase transformers. CLO3: Identify the characteristics of auto transformers and instrument transformers. CLO4: Quantify the losses in power transformers by performing laboratory tests. CLO5: Describe the constructional features of synchronous machines, principles of operation and applications. CLO6: Explain the constructional features, operating principle, characteristics, speed controlling and starting methods of various AC and DC machines. CLO7: Identify characteristics of AC and DC machines by conducting laboratory tests.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Single and three phase transformers Session 1: Introduction to electrical machines Session 2: Introduction to transformers (Ideal, practical, auto, CT, PT) Session 3: Three phase transformers, connection types and paralleling Session 4: Mounting and cooling methods of electrical machines Unit 2: Synchronous machines Session 5: Introduction to synchronous machines Session 6: Armature reaction and space-time vector diagram of synchronous generator Session 7: Steady-state equivalent circuit of a cylindrical rotor synchronous generator Session 8: Steady-state operation of a cylindrical rotor synchronous machine Session 9: Two-axis theory of salient-pole synchronous machine Session 10: Steady-state operation and control of synchronous generators Session 11: Operation and control of synchronous motors Session 12: Determination of steady-state synchronous reactance Session 13: Excitation systems of synchronous machines Session 14: Stability of synchronous machines Unit 3: DC machines Session 15: DC rotating machine theory Session 16: Generated EMF and armature reaction Session 17: DC Generators Session 18: Starting methods and speed torque characteristics of DC motors Session 19: Speed control of DC motors and parallel operation of DC generators Session 20: Characteristics of DC motors Session 21: Characteristics of DC generators Unit 4: AC machines Session 22: Generation of 3-phase voltages

	Session 23: Principles of induction motor action Session 24: Electromagnetic interactions in induction motors Session 25: Induction machine equivalent circuit Session 26: Determination of induction machine equivalent parameters Session 27: Characteristics and performance of 3-phase induction motors Session 28: Starting and speed control of induction motors Session 29: Generating and braking modes of 3-phase induction machines Session 30: Single phase induction motor **Laboratory work:** 1. a. Perform open circuit test and short circuit test on single phase transformer b. Determine transformer performance parameters 2. a. Determine characteristics of plain compound DC motor b. Determine characteristics of three-phase induction motor 3. Experiments with shunt wound DC motor and DC Generator 4. Experiments with the slip ring rotor Induction motor Experiments with the synchronous Generator and synchronous Motor

EEX4542 Power systems I

Level	4
Course Code	EEX4542
Course Title	Power systems I
Credit value	5
Core/Optional	Core (Electrical)
Course Aim/s	To provide knowledge of various methods of electrical power generation. To provide knowledge of electrical power systems and the role of power engineering profession.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Describe electrical power generation technologies. CLO2: Explain load characteristics and economical aspects of power utilization. CLO3: Demonstrate the knowledge of substation equipment and their roles. CLO4: Demonstrate knowledge on characteristics and construction of overhead transmission lines and underground cables. CLO5: Analyze the performance of short and medium length transmission line. CLO6: Calculate and analyze short circuits in electrical systems. CLO7: Explain power quality issues in electrical power systems.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Technical Aspects of Electrical Power Session 01: Technical factors affecting economics of electricity supply Session 02: Electrical power generation Session 03: Non-conventional energy sources for electrical power generation Session 04: Load Characteristics (Load factor, utilization factor) Session 05: Electricity tariffs and the economy of power factor improvements Unit 2: Substations and their equipment Session 06: Sub stations and Bus-bar arrangements Session 07: Theory of circuit interruption Session 08: Types of circuit breakers and Isolators Session 09: Instrument and protective transformers Unit 3: Overhead lines Session 10: Parameters of overhead lines Session 11: Overhead line insulators Session 12: Potential distribution of suspension insulators Session 13: Testing of insulators Unit 4: Cables Session 14: Types of underground cables Session 15: Electrical stresses and capacitance in cables Session 16: Capacitive and inter-sheath grading of cables Session 17: Cable laying and jointing Unit 5: Electrical characteristics of Distribution Systems Session 18: Per unit representation/Conversion of per unit quantities Session 19: Distribution lines Session 20: AC distribution lines Session 21: Performance of transmission and distribution lines (ABCD, T, Pi) Session 22: Qualitative comparison of different distribution systems Session 23: Feeders distributors and supply mains Unit 6: Quality of Electrical Power Session 24: Voltage regulation Session 25 : Power loss minimization Session 26: Harmonics in power systems

	Unit 7: Fault Analysis in Power Systems Session 27: Symmetric fault analysis Session 28: Short circuit current in synchronous generators Session 29: Bus impedance matrix in short circuit calculations Session 30: Symmetrical components 1 Session 31: Symmetrical components II Session 32: Sequence network Session 33: Unbalanced fault analysis – Part I Session 34: Unbalanced fault analysis – Part II
	Laboratory work: 1. a. Study the current ratings of fuse & MCB b. Power factor correction in AC circuits c. Measurement of power and energy 2. a. Simulation of bus-bar operation b. Verification of characteristics of three phase transmission lines 3. Verification of symmetrical components for a three phase power system **Field visit:** Visit one of power plants

EEX5338 High Voltage Engineering

Level	5
Course Code	EEX5338
Course Title	High Voltage Engineering
Credit value	3
Core/Optional	Core (Electrical)
Course Aim/s	To provide knowledge of high voltage principles, equipment, measurements and testing
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: State fundamental rules and Identify safety regulations while doing high voltage experiments such as safety locking, earthlings, test setup and mode of action in case of electrical accidents CLO2: Explain the failure mechanism of solid, liquid and gaseous insulation and analyse the same at high voltages. CLO3: Explain the lightning and surge phenomenon in power systems and illustrate the same and overhead transmission lines during high voltage transients. CLO5: Evaluate the power losses, insulation properties, dielectric stresses and thermal design of high voltage cables and bushings. CLO6: Analyze high voltage impulse generation techniques to appropriately apply in different design principles of testing and measurements CLO7: Select economically and operationally acceptable levels of the cost and disturbances caused by insulation failure and resulting power system outages through proper insulation coordination. CLO8: Explain HVDC transmission systems involve in high voltage power transmission and identify its merits and demerits.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Breakdown of Gaseous Liquid and Solid Insulation Session 1: Ionization & Break down Characteristics of Gases Session 2: Break down of Liquid Insulating Materials Session 3: Break down of Solid and Composite Insulation materials Unit 2: Lightning Phenomena Session 4: Mechanism of Lightning Session 5: Effects of Lightning on a transmission line Unit 3: High Voltage Transient Analysis Session 6: Surges on transmission lines Session 7: Bewely Lattice diagram Unit 4: High Voltage Cables Session 8: Power losses Session 9: Dielectric stress Session 10: Thermal design and high voltage bushings Unit 5: Measurement of high voltages Session 11: Transformer and potential divider methods of measurement Session 12: Measurement of surges Session 13: Measurement of capacitance and loss tangent Unit 6: High voltage generators for testing Session 14: Generation of high alternating voltages Session 15: Generation of high direct voltages Unit 7: High voltage surge generators Session 16: High voltage impulse generators Session 17: Operation of impulse generator Session 18: Multi-stage impulse generators

	Unit 8: High voltage testing Session 19: General tests carried out on High voltage equipment Session 20: Test on insulators, transformers, cables and high voltage bushings Unit 9: Insulation co-ordination Session 21: Statistical method of insulation co-ordination Session 22: Surge protection Unit 10: High Voltage Direct Current transmission Session 23: Historical background and comparison of a.c./d.c. transmission Session 24: HVDC convertor arrangement and operation Session 25: HVDC control characteristics
	Laboratory work : 1. a. Safety Regulations for HV experiments (Introduction, Fundamental rules, Safety locking, Earthing, Circuit & test setup, Mode of action in case of Electrical accidents) b. Generation and measurement of DC and impulse voltage (Generation of high direct voltages, Generation of impulse voltages. 2. Breakdown of materials (Breakdown test of insulation oil, AC flash over test on an insulator, Break down test of gaseous insulating material) Partial discharge and Corona (Partial discharge at a Needle Electrode in Air, Corona Discharge in a coaxial cylindrical field)

EEY4182 Group Project (Electrical Engineering)

Level	4
Course Code	EEY4182
Course Title	Group Project (Electrical Engineering)
Credit value	1
Core/Optional	Core
Course Aim/s	Aim of this course is to instil in learners the ability to investigate problems and/or issues by following a methodical and a shared approach, to discover the required areas of knowledge in providing sustainable solutions.
Course Learning Outcomes (CLO):	CLO1: To apply concepts and principles in a related area of study; analyse information and suggest solutions to selected problems. CLO2: To communicate successfully, the results of analysis and arguments to specialist and non-specialist audiences. CLO3: To exercise responsibilities as an individual and as a team. CLO4: To display qualities and transferable skills as well as subject specific skills necessary for employment, carry out further training and to manage their own learning.
Content (Main topics, sub topics)	The content is based on prior learning and information researched

EEW4301 Industrial Training I (Electronics)

Level	4
Course Code	EEW4301
Course Title	Industrial training I (Electronics)
Credit value	3
Core/Optional	Core (Computer, Electrical)
Course Aim/s	Aim of this course is to prepare learners for their future employment in the industry by gaining skills in engineering practices with an exposure to industrial environment including social and ethical responsibilities.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Recall the learned relevant theories, standards, conventions and practices in electronic engineering. CLO2: Apply the relevant methods of engineering practice. CLO3. Apply theories in solving problems in electronics industry. CLO4: Apply standard safety measures in electronics industry. CLO5: Demonstrate ethical and socio-economic practices in industry. CLO6: Communicate engineering information effectively to technical and non-technical audiences. CLO7: Demonstrate ability to work effectively in team environments.
Content (Main topics, sub topics)	No study materials

EEX5352 Power Systems II

Level	5
Course Code	EEX5352
Course Title	Power Systems II
Credit value	3
Core/Optional	Core (Electrical)
Course Aim/s	To demonstrate knowledge and capability to analyse large scale power systems under normal and faulted operating conditions. To demonstrate essential knowledge of power system protection.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Demonstrate subject specific skills with respect to assessment of the stability of networks in steady and transient states. CLO2: Analyze the performance of long length transmission lines. CLO3: Evaluate and select appropriate protection schemes for electrical power systems. CLO4: Apply theory of power flow to simple models of power systems to determine active and reactive power, load angle and voltage at buses. CLO5: Perform load flow analysis using appropriate simulation software to explore the behaviour of real power systems in both normal and abnormal conditions. CLO6: Demonstrate the knowledge of optimal load sharing method between generation units and power system control.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Stability of synchronous generators Session 01: Stability of Synchronous machines Session 02: Swing curve Session 03: Swing Equation Session 04: Solution of the swing Equation Session 05: Equal area criterion Unit 2: Long length transmission lines Session 06: Generalized transmission line constant Session 07: Performance of Transmission lines I Session 08: Performance of Transmission lines II Unit 3: Power system protection Session 09: Fundamentals of protection Session 10: Over current protection of transmission line Session 11: Differential relays Session 12: Pilot wire protection Session 13: Distance relays Unit 4: Power flow calculations Session 14: Introduction to load flow studies Session 15: Approximate load flow analysis Session 16: Load flow solutions using Gauss-Seidel Techniques Session 17: Load flow solutions using Newton-Raphson Techniques Session 18: Special features of load flow Programmes Unit 5: Economic dispatch Session 19: Parallel operation of generators Session 20: Optimal load dispatch Session 21: Optimal unit commitment and merit order

	Laboratory work: 1. Over current protection of transmission lines 2. Differential protection **Mini project:** 1. Load flow calculation of large systems using commercial software packages

EEX5453 Power Electronics

Level	5
Course Code	EEX5453
Course Title	Power Electronics
Credit value	4
Core/Optional	Core (Electrical), Elective (Electronic and communications)
Course Aim/s	To provide knowledge of power electronics and its development as an energy conservation strategy
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Identify the emergence of power electronics as an energy conservation strategy. CLO2: Describe the characteristics and specifications of power semiconductor devices. CLO3: Apply gate driver circuits in power electronic systems for a given design requirement. CLO4: Analyze the performance of single and three phase AC to DC converters. CLO5: Analyze AC voltage control methods using AC to AC converters. CLO6: Analyze the function and characteristics of DC to DC converter topologies. CLO7: Assess the working principle of DC to AC converters. CLO8: Demonstrate Power quality concerns in industrial power electronics. CLO9: Review protection requirements for power electronic systems.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Introduction to power electronics Session 1: History and evolution of power electronics Session 2: Basic Power Electronic Systems Session 3: Review of AC theory and Signals Session 4: Introduction to power semiconductor devices Session 5: Gate driver circuits for power electronics Unit 2: AC to DC converter (Rectifiers) and AC to AC converter (AC voltage controllers) Session 6: Power diodes and thyristors Session 7: Diode rectifier circuits Session 8: Single phase controlled rectifiers Session 9: Three phase controlled rectifiers Session 10: AC voltage controllers – On off control and phase control Session 11: Cycloconverters Unit 3: DC to DC converters (Choppers) Session 12: Power transistors – IGBT and MOSFET Session 13: Step down operation – Buck converter Session 14: Step up operation – Boost converter Session 15: Buck - Boost converter and Cuk converter Session 16: Four quadrant operation and full bridge DC – DC converter Session 17: Switch mode voltage regulators Unit 4: DC to AC converters (Inverters) Session 18: Operating principle of inverters Session 19: Three phase inverter Session 20: Voltage control of single phase inverters Session 21: Voltage control of three phase inverters Session 22: Multi-level switching Session 23: Resonant pulse inverters Unit 5: Practical considerations of power electronic systems Session 24: Static switches Session 25: Applications of power electronic systems

	Session 26: Electro Magnetic interference in power electronics Session 27: Harmonics in Power Electronics Session 28: Protection schemes for power electronic devices Session 29: Thermal modeling and heat sinks Session 30: High frequency transformers **Laboratory work:** 1. (a) Design and analyze performance of rectifier circuits (b) Design and analyze performance of inverter circuits 2. Design DC – DC converter 3. Design AC voltage controller using phase control methods

EEX5348 Electrical Machines and Drives

Level	5
Course Code	EEX5348
Course Title	Electrical Machines and Drives
Credit value	3
Core/Optional	Core (Electrical)
Course Aim/s	To provide knowledge of special purpose electrical machines and drive systems used in industrial applications.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Describe the operating principle, constructional features and characteristics of special purpose electrical machines and their drives. CLO2: Design appropriate drive systems for special purpose machines using simulation software's. CLO3: Analyze the behavioural pattern of synchronous machines during transient operations. CLO4: Identify different types of DC motor drives and analyse their performance in various applications. CLO5: Explain three phase induction motor drive systems and analyse their performance. CLO6: Compute thermal and electrical ratings of motors under normal and specified environments.
Content (Main topics, sub topics)	**Outline Syllabus:** Unit 1: Special purpose electrical machines Session 1: Fundamentals of electric drives Session 2: Brushless DC motors (BLDCM) and drives Session 3: Stepper motor drives and switch reluctance motor drives Session 4: Single phase induction motor drives Unit 2: Synchronous machine and drives Session 5: Transient performance of synchronous generator Session 6: Variable frequency operation Session 7 : Synchronous motor drives Unit 3: DC motor drives Session 8: Thyristor DC drives-General Session 9: Control arrangements for DC drives Session 10: Chopper- fed DC motor drives Session 11: DC servo drives Unit 4: AC motor drives/Induction motor drives Session 12: Variable frequency operation of Induction motor Session 13: Inverter-fed induction motor drives(I) Session 14: Inverter-fed induction motor drives(II) Session 15: Cyclo-converter drives Unit 5 - Operational aspects of Electrical machines Session 16: Thermal rating of electrical machines Session 17: Operational aspects of electric motors Session 18: Motor /drive selection **Laboratory work:** 1. MATLAB simulations for BLDC motor performance V/F method of speed control of induction motor using MATLAB simulations

EEX6182 Research Methodology and Project Identification (Electrical)

Level	6
Course Code	EEX6182
Course Title	Research Methodology and Project Identification (Electrical)
Credit value	1
Core/Optional	Core
Course Aim/s	To provide the student with knowledge of research based approach in providing solutions to engineering problems
Course Learning Outcomes (CLO):	After completion of this course student will be able to: CLO1: Demonstrate the knowledge of types of research designs, quantitative and qualitative forms of research, and use the most appropriate design for a given issue. CLO2: Create problem statement, purpose statement, research problem and objective of a research. CLO3: Conduct a literature survey effectively in view of information collection with regard to a given issue, critically evaluate outcomes of literature survey, and document them with recognized referencing methods. CLO4: Prepare a research proposal based on preliminary investigations. CLO5: Describe ethical issues concerning research and identify and avoid such issue in engineering research. CLO6: Plan and execute substantially research based projects with innovativeness and initiative and with a personal autonomy and accountability. CLO7: Prepare research abstracts and full length articles according to standard formats.
Content (Main topics, sub topics)	**Outline Syllabus:** Session 01: Meaning and objectives of research Session 02: Types of research Session 03: Literature survey and referencing methods Session 04: Defining a research problem Session 04:Prepartion of a research proposal Session 05:Ethics in research Session 06:Dessemination of research outcomes and patenting **Activities:** Workshop on research problem formulation

EEX6354 Comprehensive Electrical Engineering Design

Level	6
Course Code	EEX6354
Course Title	Comprehensive Electrical Engineering Design
Credit value	3
Core/Optional	Core
Course Aim/s	Aim of this course is to provide comprehensive hands on experience in designing and development of an electrical engineering solution for a given case
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Investigate design requirements for a given case in electrical engineering. CLO2: Design a system according to the case requirement considering socio-economic and environmental impacts. CLO3: Implement a prototype or a simulation model for the design. CLO4: Evaluate the performance of implemented prototype or the simulation in a similar environment to the given case. CLO5: Recommend necessary improvements to the design, considering evaluation results.
Content (Main topics, sub topics)	**Outline Syllabus:** **Unit 1 Comprehensive electrical engineering design** Session 1: Electrical engineering project acquisition Session 2: Review of circuit theory Session 3: Design concept Session 4: Computer aided design Session 5: Conceptual prototype design and implementation Session 6: Review of electrical measurements and instrumentation Session 7: Measuring and evaluation of performance of a prototype Session 8: Professional and ethical development **Design Projects:** 1. Design a system for a given case in electrical engineering Evaluate performance and recommend improvements to the design

EEW6502 Industrial Training II (Electrical power - Undergraduate)

Level	6
Course Code	EEW6502
Course Title	Industrial training II (Electrical power - undergraduate)
Credit value	5
Core/Optional	Core (Electrical)
Course Aim/s	Aim of this course is to expose learners to recognize power systems planning, design & construction, operation & control processes subjected to techno-economical, environmental, social, ethical, health and safety constraints, while gaining self-confidence.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to CLO1: Recall learned theories and associated laboratory experiments while applying the knowledge of electrical power Generation/Transmission/Distribution to analyse and interpret the collected data and observations. CLO2: Recognize the power systems Planning, Design & Construction, Operation & Control processes to meet desired outputs subjected to the techno-economical, environmental, social, ethical, health and safety constraints. CLO3: Appreciate terms and regulations set up by the organizations. CLO4: Discuss merits and demerits of alternative solutions for problems and issues in engineering as a team while working with the professionals and non-professionals in the working environment. CLO5: Apply the appropriate techniques, resources, skills and engineering tools necessary for modern day power systems engineering practices knowing their limitations. CLO6: Respond to the organization's work ethics in terms of interpersonal interactions, discipline, rules/regulations and methods of performing assigned tasks. CLO7: Reflect effective report-documentation, oral-communication and clear-presentation skills in a multi-disciplinary environment. CLO8: Generate self-confidence through acquired technical and managerial skills.
Content (Main topics, sub topics)	No study materials

EEX7231 Advanced Circuit Design and Analysis

Level	7
Course Code	EEX7231
Course Title	Advanced Circuit Design and Analysis
Credit value	2
Core/Optional	Core (Electrical)
Course Aim/s	To gain proficiency in design and analysis of linear and nonlinear electrical systems and development of algorithms for high performance circuit simulations
Course Learning Outcomes (CLO):	At the completion of this course student will be able to: CLO1: Use algorithms and techniques for fast and effective simulation of circuits. CLO2: Use iterative methods for DC analysis including non-linear elements. CLO3: Perform transient analysis for time domain simulations, using differential equations. CLO4: Apply state space analysis for time and frequency domain simulations of higher order circuits. CLO5: Perform sensitivity and tolerance analysis for qualitative improvement in circuit design.
Content (Main topics, sub topics)	**Outline Syllabus:** **Unit 1 Introduction to advanced circuit analysis methods** Session 1: Overview of circuit simulation-Equation formation basics Session 2: Algorithms for circuit solving (Gaussian elimination, LU factorization, Runga-Kutta, Cholesky, Predictor-Corrector, Sparsity Programming) Session 3: Non-liner device modelling Session 4: Simulation – DC analysis Session 5: Simulation – transient analysis **Unit 2 Frequency domain analysis and evaluation of circuit designs** Session 6: Transmission line simulation Session 7: State space analysis Session 8: Simulation – AC analysis Session 9: Sensitivity, tolerance and noise analysis in circuit design Session 10: Evaluation of circuit designs **Case study:** 1. Non-linear DC and transient circuit analysis 2. State space analysis and frequency domain AC analysis **Design Project:** Design of an electrical network and analyse the stability and sensitivity using simulation.

EEX7432 Power system planning operation and controls

Level	Level 7
Course Code	EEX7432
Course Title	Power system planning operation and controls
Credit value	4
Core/Optional	Core (Compulsory)
Course Aim/s	• To demonstrate knowledge and capability to analyse large scale power systems under normal and faulted operating conditions. • To demonstrate essential knowledge of power system protection.
Course Learning Outcomes (CLO):	At the completion of this course student will be able to CLO1: Explain the energy sector and energy policy in Sri Lanka. CLO2: Describe and confidently apply load forecasting techniques and classify the same based on various test methods. CLO3: Analyse relevant parameters and interpret various issues pertaining to generation planning, operations, reliability and controls. CLO4: Analyse relevant parameters and interpret various issues pertaining to transmission & substation planning, design, construction, operations and reliability. CLO5: Analyse relevant parameters and interpret various issues pertaining to distribution planning, design and reliability. CLO6: Evaluate generation planning concepts and their techno-economic considerations. CLO7: Evaluate transmission and substation planning concepts and their techno-economic considerations. CLO8: Evaluate distribution planning concepts and their techno-economic considerations. CLO9: Identify the environmental impacts of electricity generation, transmission & distribution and explain measures to be taken for mitigation. CLO10: Compare the different methods used by electricity utilities to cost their customers. CLO11: Evaluate energy management programs while meeting national policy objectives.
Content (Main topics, sub topics)	**Block-1** **<u>Power system Planning</u>** **Unit-1: The Electricity Sub-sector** **Session 1:** Introduction to the Energy Sector **Session 2:** Energy Policy and the Electricity Sector **Session 3:** The Electricity Supply Industry in Sri Lanka **Session 4:** An Overview of Power System Planning **Unit-2: Demand Forecasting** **Session 5:** Time-trend and Time-series Techniques for Demand Forecasting **Session 6:** Econometric Modelling of Electricity Demand **Session 7:** End-use Methods in Demand forecasting **Unit-3: Generation Technology**

	Session 8: Power Generation Technology Part-I **Session 9:** Power Generation Technology Part-II **Session 10:** Power Generation Technology Part-III **Session 11:** Power Generation Technology Part-IV **Unit-4: Planning of Operations** **Session 12:** Economic dispatch of thermal generating units **Session 13:** Optimal generation Scheduling **Session 14:** Unit commitment **Session 15:** Cascaded Hydroelectric systems and Hydro-Thermal coordination **Unit-5: Generation Planning** **Session 16:** Economic screening of Generation options **Session 17:** Reliability of Generators and Generating systems **Session 18:** Generation Expansion Planning Models **Session 19:** Environmental Impacts of Power Generation and their mitigation **Unit-6: Transmission Planning** **Session 20:** Transmission Planning Methodology **Session 21:** Reactive power Control and Voltage Stability I **Session 22:** Reactive power Control and Voltage Stability II **Session 23:** Real Power Control and Frequency Stability - The Governor Turbine Model **Session 24:** Real Power Control and Frequency Stability - Generator-Load Model and Static Dynamic Behaviour **Session 25:** Real Power Control and Frequency Stability - The Reset Loop and Multi-Area Operation **Block-2** **<u>Operation and Control</u>** **Unit-7: Transmission Line/Substation Planning & Design Considerations** **Session 26:** Line Routing, Conductor and Voltage Selection, and their Techno-Economic Considerations **Session 27:** High Voltage Direct Current Transmission (HVDC) **Session 28:** Substation Planning and Design Considerations **Session 29:** Reliability Considerations of Substations & Switching Systems **Session 30:** Composite reliability evaluation **Unit-8: Distribution Planning** **Session 31:** Planning of Distribution System for Urban and Suburban Areas **Session 32:** Voltage Regulation Loss Optimization in Distribution Systems **Session 33:** Reliability of Power Distribution System **Unit-9: Electricity Metering Costing & Prizing** **Session 34:** Costing of Electrical Services **Session 35:** Prizing and Metering Policy and Systems **Session 36:** Demand-Side Management: Purpose and technology

EEY7882 Engineering Research Project (Electrical)

Level	7
Course Code	EEY7882
Course Title	Engineering Research Project (Electrical)
Credit value	8
Core/Optional	Core
Course Aim/s	Aim of this course is to carry out an industry-based project during the final year, in order to demonstrate learners' exposure to professional engineering practice. It should also demand individual analysis and judgement, assessed independently from the work of others. Learners are encouraged to undertake Projects in their main discipline or to undertake projects of inter-disciplinary nature.
Course Learning Outcomes (CLO):	CLO1: To engage with selected information in the research literature to construct new knowledge related to the Research Question, the learner plans to investigate. CLO2: To plan out the investigation of a complex engineering problem using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. CLO3: To display qualities and transferable skills as well as subject specific skills necessary to communicate successfully, to a specialist audience. CLO4: To construct/create/make/build knowledge based on established pre-knowledge and techniques, using the Scientific Method. CLO5: To apply suitable/recognised methods, tools and procedures when executing the work. CLO6: To demonstrate individual analysis and judgement based on reflective learning (Concrete Experience, Reflective Observations, Abstract Conceptualisation, and Active Experimentation). CLO7:To verify accuracy and relevance of the proposed methodology and research findings. CLO8: To design and develop suitable concepts and models (graphical, mathematical, statistical, prototype) to analyse, interpret and communicate research findings. CLO9: To disseminate research findings in a professional and ethical manner.
Content (Main topics, sub topics)	The content is based on prior learning and information researched.