OUR VISION

To be the internationally recognized centre of excellence in Sri Lanka for higher education, research and development activities in the broad field of Electrical Engineering.

OUR MISSION

To produce Electrical Engineering graduates that have been trained to nurture an inquiring mind and have developed skills to face a diversity of challenges with emphasis on national relevance, innovation and creativity and employability while being a leader in contributing to sustainable scientific, technological, social and economic development of Sri Lanka.

Department of Electrical Engineering

Undergraduate Handbook

University of Moratuwa

Katubedda, Moratuwa 10400

Sri Lanka

Printed in 2014.

Forward

The Department of Electrical Engineering of the University of Moratuwa, Sri Lanka, gladly welcomes you to be a part of this glorious seat of learning. As fresh undergraduates in Electrical Engineering you will be introduced to a highly stimulating intellectual environment with an interesting range of subjects during your stay in the Department. This handbook is aimed at providing you with relevant academic information which we hope you will find useful throughout your undergraduate career in the field of Electrical Engineering.

Learning is an enthralling experience. It does not entail the academic components alone. Learning and acquisition of knowledge best take place in a setting of cross disciplinary exposure. Our department is equipped to guide you through your stay here with a learning experience starting from fundamentals progressing gradually to most modern concepts in electrical engineering. These academic instructions are augmented with pragmatic sessions with the industrial partners and professional experts. We consider it equally important to assist you in personality development too before you graduate as a budding engineer. Therefore, the Department participates in a number of entertaining extra-curricular activities that are organized by the Electrical Engineering Society, in addition to sports and many other social activities conducted regularly by the University.

It is our sincere hope that you will make the maximum benefit out of the rare opportunity of belonging to a learned community of a prestigious institution. Do take time to read through the information and guidances provided here and become familiar with the Department and its resources before you start in earnest.

I would like to acknowledge the support, guidance and the creative ideas received from the academic staff of the Department in compiling this handbook.

I wish you all the best during your stay at the Department and hope to see you at the graduation ceremony sooner rather than later.

NW
Department of Electrical Engineering
September 2014

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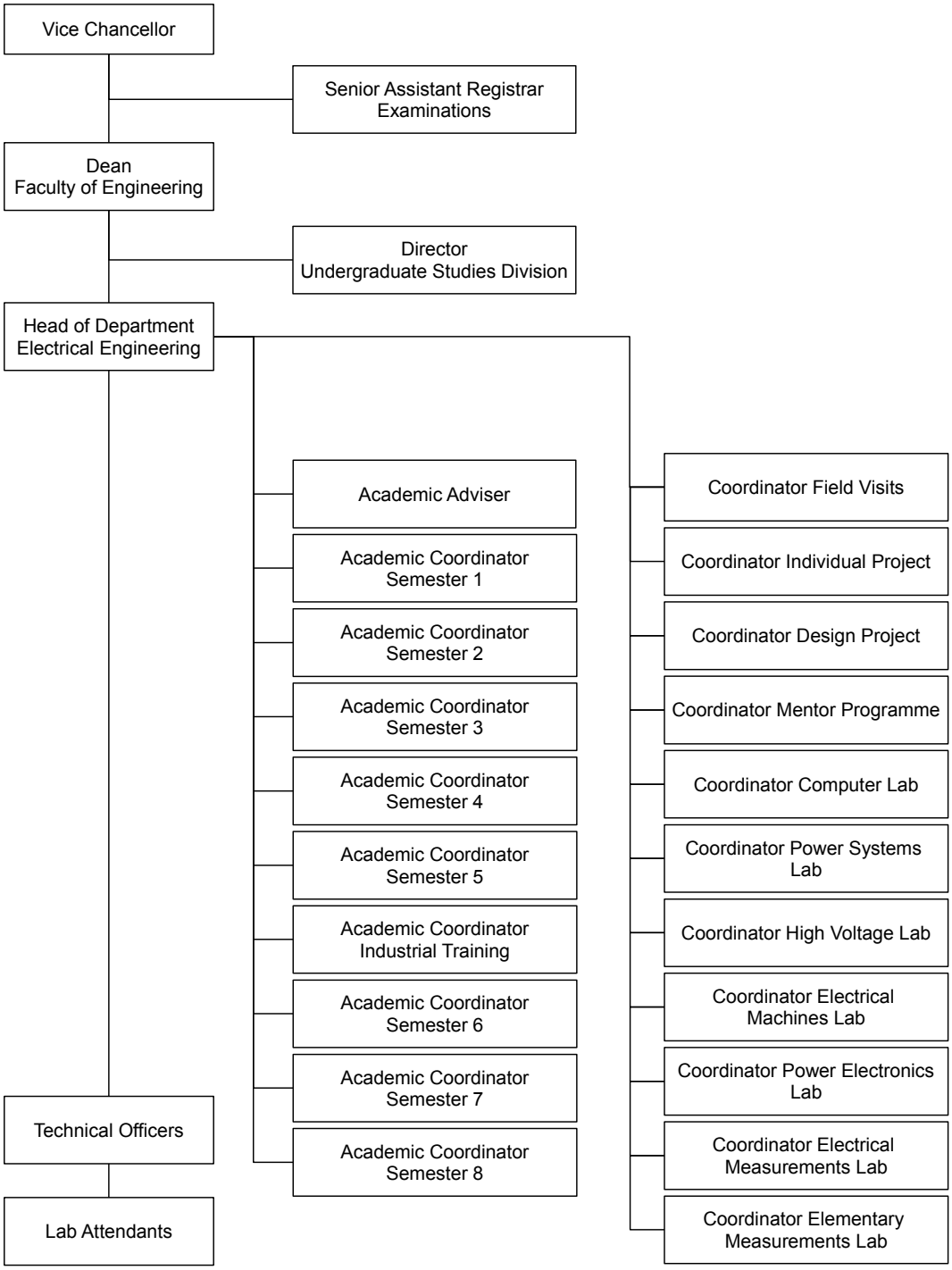
Organisational Chart



Organizational chart of the Department of Electrical Engineering (Undergraduate Programme)

Welcome

It is with great pleasure and affection that I welcome you to the Department of Electrical Engineering as the new group of undergraduates in the current year. I congratulate you for being successful in the competition for securing a place in this department. From now on you are a valued member of this department with every right and freedom to enjoy its facilities, privileges and esteem.

The Department of Electrical Engineering in recent times has undergone significant changes and expanded its scope to accommodate new challenges of the 21st century. One of the main revisions was in the area of utilization of electrical energy. The scope of the undergraduate degree programme now covers the key areas of industrial motor drives, power electronics, electric transportation, artificial lighting, electrical construction, building services, system automation, intelligent systems, mechatronics, and robotics. A comprehensive curriculum revision was also carried out in the area of generation, transmission and distribution of electrical energy. Utility management, renewable energy, energy sector forecasting and planning, nuclear power, product development, and many other interdisciplinary areas have been introduced to the curriculum. Optional subjects offered by other academic departments in the areas of IT, software and electronics are open for electrical engineering students

In Semester 2 of your academic program, we concentrate on the fundamentals of Electrical Engineering. Subjects related to the core practices of Electrical Engineering are offered from Semester 3 onwards. During Semester 6 you will undergo Industrial Training for a period of 24 weeks and the knowledge and the skills you acquire will be very useful in developing your practical orientation. Part of your industrial training will be at the Ceylon Electricity Board and Lanka Electricity Company where your will obtain practical experience on the operation of an electrical power system. The other part of your training will be at a public or private institute dealing with Electrical Engineering practice. Field visits are arranged regularly at each level to enable you to observe the real-life practice of Electrical Engineering with the guidance of the academic staff. The mentoring programs at Level 3 and 4 will help you to strengthen your outlook and personality. You will implement a group project in Semesters 7 and 8, where you will be putting to practice the theories you have learnt.

The department has eight well equipped laboratories namely, the Power Systems Laboratory, Electrical Machines Laboratory, Power Electronics Laboratory, High Voltage Laboratory, Electrical Construction Laboratory, Computer Laboratory, Electrical Measurements Laboratory, and Elementary Measurements Laboratory. Three other state of the art laboratories in Artificial Lighting, Industrial Automation and Renewable Energy are to be established in the near future. The practical classes conducted in these laboratories will enable you to study the practical aspects of the theories you have learnt.

The Electrical Engineering Society is the social wing of the department. All students become members of this society and participate actively in organizing various social functions. It helps immensely to sustain the friendly atmosphere of staff and students in the department.

I am sure you will have a very interesting time ahead. I, together with other members of the staff wish you a very productive and a happy stay in this department. We wish to see you graduating as competent Electrical Engineers who will contribute to improving the well-being of the people of this country. I wish you all the best.

Prof. M. P. Dias
Head, Department of Electrical Engineering

Department of Electrical Engineering

Organisation of the Department

The Head of Department is the principal executive officer responsible for both academic and non academic administration of the Department. The other senior academic staff members help the Head of Department to conduct the day to day administration in their capacity as Semester Coordinators, Project Coordinators, Coordinators of field visits and training etc. In addition, the Department has a permanent academic adviser to help the students with their academic matters. The laboratories are overseen by respective technical officers with the help of other technical staff attached to each laboratory. An academic staff member is also assigned to every laboratory to be in overall charge of the administrative duties.

The Electrical Department presently conducts one undergraduate degree programme leading to B.Sc. Engineering Honours degree in Electrical Engineering, and three part-time postgraduate courses, namely, M.Sc. in Electrical Engineering, M.Sc. in Electrical Installations and M.Sc. in Industrial Automation The Electrical Department also collaborates with Civil and Mechanical Engineering Departments to offer an M.Sc. course in Building Services. Postgraduate degree courses cater to the needs of the students who wish to specialise in industry oriented specialisations in electrical engineering beyond their first degree. The Department also offers postgraduate research programmes up to the level of Ph.D. degree.

Academic Coordinators and Advisers

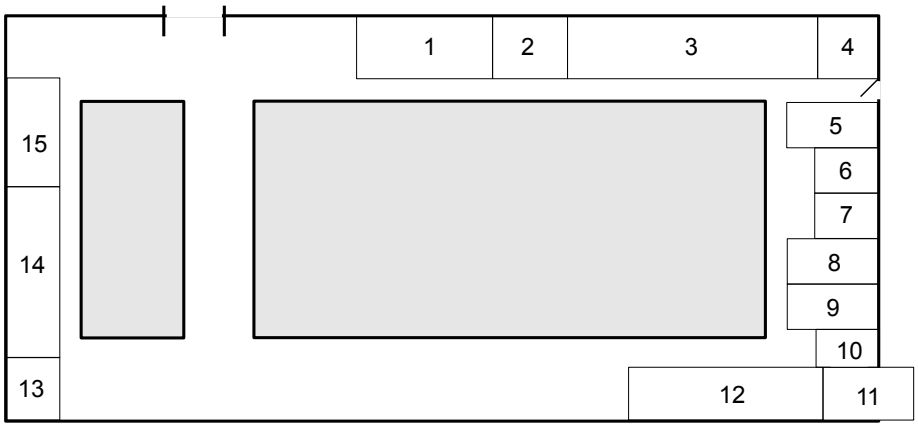
Presently the undergraduate degree program is coordinated by following senior academic members under the guidance of Head of the Department.

Function	Coordinator
Academic Adviser	Prof. J.R. Lucas
Academic Coordinator – Semester 1	Ms L.P.J.P. Premaratne
Academic Coordinator – Semester 2	Prof. N. Wickramarachchi
Academic Coordinator – Semester 3	Dr. Lidula N. Widanagama Arachchige
Academic Coordinator – Semester 4	Dr. W.D.A.S. Rodrigo
Academic Coordinator – Semester 5	Dr. D.P. Chandima
Academic Coordinator – Industrial Training	Dr. S. Namasivayam
Academic Coordinator – Semester 6	Dr. Saranga K. Abeygunawardana
Academic Coordinator – Semester 7	Dr. K.T.M.U. Hemapala
Academic Coordinator – Semester 8	Dr. A.G.B.P. Jayasekara
Field Visits	Dr. W.D.A.S. Rodrigo
Design Project	Dr. A.M.H.S. Abeykoon

Function	Coordinator
Individual Project	Dr. K.T.M.U. Hemapala
Mentoring Programme	Dr. S. Namasivayam
Computer Laboratory	Dr. A.G.B.P. Jayasekara
Power Systems Laboratory	Dr. K.T.M.U. Hemapala
High Voltage Laboratory	Eng. W.D.A.S. Wijayapala
Electrical Machines Laboratory	Dr. D.P. Chandima
Power Electronics Laboratory	Prof. J.P. Karunadasa
Electrical Measurements Laboratory	Dr. A.M.H.S. Abeykoon
Elementary Measurements Laboratory	Ms L.P.J.P. Premaratne

Location and Floor-plan

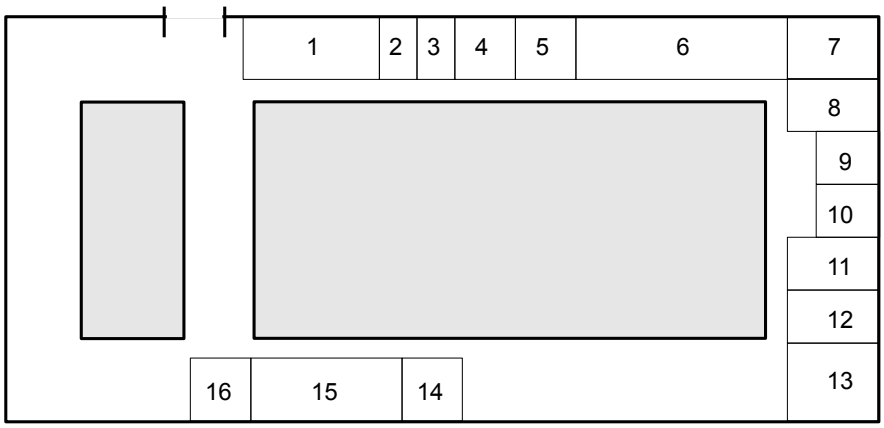
The Department and its divisions are housed at Ground Level, 1st Floor and 2nd Floor of the Dr. L.H. Sumanadasa building. The Office room together with the room of Head of Department are located on the 1st Floor. Location of rest of the Departmental facilities including laboratories and staff rooms are illustrated in the following floor plans.



Ground Level

Key	Room (Ground Level, Sumanadasa Building)
1	Computer Laboratory
2	Staff room – Dr. Harsha S. Abeykoon
3	Power Systems Laboratory
4	High Voltage Laboratory
5	Staff room – Dr. A.G.B.P. Jayasekara
6	Staff room – Dr. D.P. Chandima

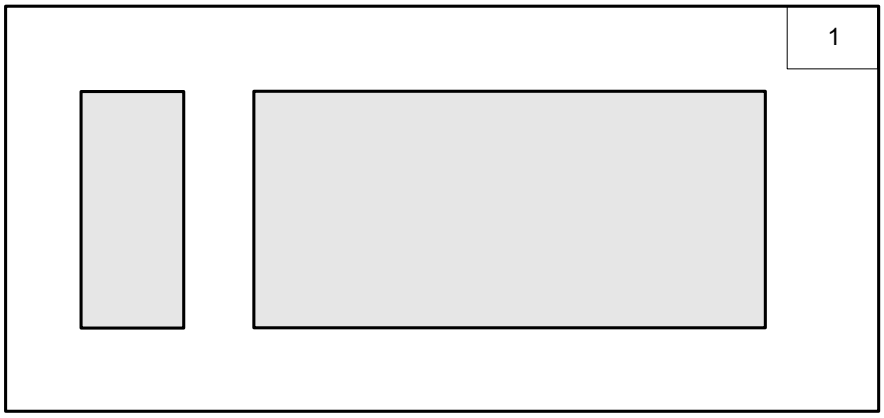
Key	Room (Ground Level, Sumanadasa Building)
7	Staff room – Dr. K.T.M.U. Hemapala
8	Staff room – Prof. N. Wickramarachchi
9	Staff room – Eng. W.D.A.S. Wijayapala
10	Department workshop
11	Undergraduate project Laboratory
12	Electrical Machines Laboratory
13	Postgraduate research Laboratory
14	Common staff rooms
15	Power Electronics Laboratory



First Floor

Key	Room (First Floor, Sumanadasa Building)
1	Electrical Engineering seminar room
2	Senior staff common room
3	Electrical Engineering Board room
4	Head of the Department
5	Department office
6	Electrical Measurements Laboratory
7	High Voltage Laboratory (Control Room)
8	Staff room – Prof. J.R. Lucas
9	Staff room – Prof. S.P. Kumarawadu
10	Staff room – Dr. S. Namasivayam
11	Staff room – Prof. H.Y.R. Perera

Key	Room (First Floor, Sumanadasa Building)
12	Staff room – Prof. J.P. Karunadasa
13	Staff rooms – Prof. M.P. Dias, Dr. Asanka Rodrigo, Dr. L. N. Widanagama Arachchige, Dr. S. K. Abeygunawardane, Dr. Upuli P. Jayatunga
14	Elementary Measurements Laboratory
15	Electrical Installation Laboratory
16	Staff room



Second Floor

Key	Room (Second Floor, Sumanadasa Building)
1	Electrical Final Year room

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Facilities in the Department

The Electrical Department is committed to providing laboratory facilities, equipment and computing infrastructure necessary for creating a conducive learning environment for effective delivery of its undergraduate programme. We make every effort to keep these facilities up to date and relevant to the teaching modules, despite the practical constraints and limitations inherent to an educational institute financed through public funds.

Electrical Measurements Laboratory

The Electrical Measurements Laboratory has been set up mainly to teach the practical aspects of the basics of electrical theory and measurements to undergraduate and lower level courses. The associated subjects for lab classes are Theory of Electricity and Electrical Measurements and Instrumentation. The Electrical Measurements Laboratory is also used in carrying out research, consultancy and testing work.
Technical Officer - Mr. M.W.D. Wasantha

Elementary Measurements Laboratory

The Elementary Measurements Laboratory has been set up mainly to conduct practicals to first year undergraduates. The associated subject for lab classes is Electrical Engineering in Semester 1 of the BSc course. The Elementary Measurements Laboratory is also used in carrying out research, consultancy and testing work.
Chief Technical Officer - Mrs. H.A.P. De Silva

Power Systems Laboratory

The Electrical Power Systems Laboratory has been set up mainly to teach the practical aspects of Power Systems Engineering to students at all levels. At present the laboratory classes of the subjects, Introduction to Power Systems, Generation & Transmission, Power Systems Protection, Power Distribution & Utilization, and Power System Analysis are conducted in this laboratory. The Power Systems Laboratory is also used in carrying out research, consultancy and testing work.
Technical Officer - Mr. H.D.A. Chandana

Electrical Machines Laboratory

The Electrical Machines Laboratory has been set up mainly to teach the practical aspects of Electrical Machines to students at all levels. At present the laboratory classes of the subjects, Introduction to Electrical Machines, Induction Machines, and Electrical Drives & Applications, are conducted in this laboratory. The Electrical Machines Laboratory is also used in carrying out research, consultancy and testing work.
Staff Technical Officer - Mr. J. D. Leelasiri

Power Electronics Laboratory

Power Electronics laboratory has been set up to facilitate students to learn Power Electronics and its applications. The Power Electronics Laboratory deals with the Power Electronics aspects of the Electrical Machines. The Laboratory and caters to the final year undergraduate and postgraduate students only. At present the laboratory classes for subjects, Power Electronics and its Applications, and Electrical Drives and Applications

are conducted in this laboratory.. The Power Electronics Laboratory is also used in carrying out research, consultancy and testing work.
Staff Technical Officer - Mr. S.R.P. Silva

High Voltage Laboratory

The High Voltage Laboratory has been set up to cater to the final year undergraduate and postgraduate students only. At present the laboratory components of the subjects, Insulation Co-ordination and High Voltage Breakdown & Testing are conducted in this laboratory. The High Voltage Laboratory is also extensively used in carrying out research, consultancy and testing work.

Technical Officer - Mr. H.D.A. Chandana

Electrical Installation Laboratory

This laboratory, originally named as Wiring Diagrams & Electrical Construction, has been set up mainly to teach the practical aspects of Electrical Installations to students at all levels. At present parts of the laboratory classes of the subject Electrical Engineering which is offered for first year students of all fields and the subject on Electrical Installations, are conducted in this laboratory.

Craft Demonstrator - Mr. K.D.A.A. Somasiri

Computer Systems Laboratory

The Departmental computer services consist of over fifty personal computers for students and one UNIX server. The Local Area Network links most of the laboratories and staff rooms and has internet facility through the campus/LEARN network. The Computer Systems Laboratory is used by the undergraduate students and the postgraduate students for their assignments and project work, and for internet searching, email and word-processing. Associated subjects for the lab classes are Control theory and Computer Aided Design & Simulation.

Staff Technical Officer – Mr. J. Wickramaratna

Technical Officer – Ms. E.M.P.W.S.S.K. Ekanayake

Working hours and access times

Department of Electrical Engineering is usually open for academic work from 8.30 a.m. to 4.30 p.m. on weekdays except public holidays.

All laboratories in the Department of Electrical Engineering are available for students strictly during the scheduled practical sessions and students should not use any equipment without permission from the lecturer in charge or guidance of a Laboratory Instructor assigned for the practical session.

The Computer Laboratory is open from 7.30 a.m. to 8.00 p.m. on weekdays and closed on weekends. At present all other facilities are available during working hours only.

Undergraduate Programme of Study

The Electrical Department regularly revises its curriculum and syllabi in keeping with the standards of teaching excellence followed by the University of Moratuwa. Thus the contents of its programme is kept up to date and made to serve the needs of the country and students in preparing them for a future career in Electrical Engineering. The last major revision of the curriculum was done in 2009, but revisions of the syllabi of subjects and introduction of new subjects are implemented annually.

An Overview

The programme of study leading to the award of the BSc Engineering Honours Degree consists of eight academic semesters – designated as Semester 1 to Semester 8, offered over four academic years. A period of 20 weeks just prior to the beginning of Semester 6 is reserved for Industrial Training. The normal duration of academic teaching in a semester is 15 weeks and the balance period of the academic year is taken up by examinations and vacations.

Selection of fields of specialization will be made by the students at the end of Semester 1 which is common to all Engineering intake. From Semester 2 onwards the students come under the administration of the respective Departments.

The undergraduate programme in Electrical Engineering specialisation will introduce you to the fundamentals of Electrical Engineering theory in Semester 2 and from Semester 3 through 8 you will gradually learn how to apply the theory to core areas of Electrical Engineering such as Power Systems, Electrical Machines and high Voltage. You will also acquire knowledge of the principles of Electronics, Telecommunications and Computer Science during the same period .

Modules are categorized into four levels of academic progression from 1 to 4 which represent your current standing in the process of completing the 150 credits required for the degree of B.Sc. in Electrical Engineering. Note that some modules have pre-requisites from a lower level of academic progression while some others have co-requisites from the same level. Modules are categorised as either compulsory (C), elective (E) or optional (O). Student must take all compulsory modules in the curriculum. The elective modules are grouped such that a minimum number of credits from each group must be taken as specified in the curriculum. The optional modules in the curriculum may or may not be taken as per your personal preference.

Credits and Academic Load

Each module is assigned a credit value which represents the expected workload of the particular module. For a typical module extending over one Semester, one credit is equivalent to one hour of lectures per week or three hours of assignments such as tutorials, laboratory work, field work and design work per week. The industrial placement of 20 week duration is assigned six credits while the Design Project at Semesters 7 and 8 is counted as 10 credits equally distributed over both semesters.

The recommended credit load for each semester or term is called the norm and it is specified in the approved curriculum. Irrespective of the norm, maximum workload a

student could register for a Semester is 27 credits. A student must register for a minimum of 12 credits in a Semester in order to consider him or her as a full-time student.

Registration for Modules and Attendance

You will be using the Faculty online registration system *LearnOrg* at the beginning of each Semester to register for modules in that Semester. You may consult and obtain the consent of your Academic Advisor prior to applying for registration. The Academic Advisor's consent is required for adding/dropping modules after registration; obtaining leave from academic activities and changing the academic load. The add/drop period is limited to two weeks from the commencement of the Semester.

Once registered for a module, you are required to attend all the lectures, laboratory classes, tutorials, continuous assessments etc. that are part of that module. A minimum of 80% of attendance for lectures are necessary to be eligible to sit for the corresponding semester-end examination. The laboratory classes, tutorials, continuous assessments etc. will not be re-scheduled under normal circumstances and if absent you will earn no marks for the corresponding components.

Evaluation of Performance

Your performance in each module will be evaluated by adding the marks obtained for continuous assessment (CA) components and marks obtained at end-of-semester written examination (WE). The ratio of marks allocated for CA components and written examination may vary with the module, however 30% for CA and 70% for WE would be the norm for most of the modules in Electrical Engineering. Candidates should obtain at least 35% of allocated marks for each of CA and WE to pass a module in addition to the requirements described below.

Letter grades based on the Grade Point system, illustrated in the Table below, indicate the academic performance of students in each module he/she has registered for.

Benchmark %	Grade	Grade Point	Description
85 and above	A+	4.2	
75 to 84	A	4.0	Excellent
70 to 74	A –	3.7	
65 to 69	B+	3.3	
60 to 64	B	3.0	Good
55 to 59	B –	2.7	
50 to 54	C+	2.3	
45 to 49	C	2.0	Pass
40 to 44	C –	1.5	Weak Pass
35 to 39	D	1.0	Conditional Pass
Both WE and CA below34	F	0.0	Incomplete

Benchmark %	Grade	Grade Point	Description
Only WE below 34	I-we	0	Incomplete – written examination
Only CA below 34	I-ca	0	Incomplete – continuous assessment
	N	–	Academic Concession
	W	–	Withdrawn

Grade D or above is required to earn credit for a module. A student failing either CA or WE components receives an incomplete grade I, and can sit for a repeat examination in the failed component only. If a student fails both CA and WE components he or she receives an F grade, and must repeat both components in order to earn credit for that module.

The grades F, I, D or C– can be improved up to a C grade via a repeat attempt. The maximum grade awarded for repeating a module will be a C and it will be used for calculating Semester Grade Point Average (SGPA).

Grade N signifies Academic Concession granted with the approval of the Faculty in the event a student is unable to sit for the WE due to illness or other compelling reason accepted by the Senate of the University. Grade W indicates a module withdrawn by the student with the approval of the Faculty and the Senate. These grades are not counted in the calculation of the SGPA.

Note that the transcript which carries your academic performance will show the grade achieved by you in each of the module you have registered for. The grade at the first attempt or the improved grade earned at a subsequent attempt will be recorded in the transcript.

Semester Grade Point Average

The calculation of the SGPA will be based on the summation of Grade Points earned for all modules registered for credit (except those awarded with academic concession or withdrawn) in a semester weighted according to number of credits as per the following formula.

$$SGPA = \frac{\sum n_i \times g_i}{\sum n_i}$$

Where n_i is the number of credits for the i^{th} module in a given semester and g_i is the grade points earned for that module. The SGPA calculated from the formula above is rounded to the nearest second decimal place for recording.

Current Grade Point Average

The Current Grade Point Average (CGPA) describes a student's current standing in terms of all modules registered for credits up to given point of time weighted according to the grades assigned to each module. The weighting for each semester is taken as uniform for the calculation of CGPA.

Overall Grade Point Average

The OGPA is the final standing of the student calculated on the basis of CGPA of all the registered modules.

Academic Progression

If a student obtains an SGPA between 1.99 and 1.50, then he/she is placed on academic warning. If the earned SGPA is less than 1.50, the student is put on academic probation. Academic Probation and/or Academic Warning may be withdrawn when the relevant SGPA is upgraded to 2.00 or more.

A student on Academic Warning or Academic Probation will not be allowed to carry any additional academic load.

A student who falls into one of the following categories will not be permitted to register for new modules until the SGPA improves as required.

i. SGPA < 1.50 in any two semesters. (2 Academic Probations)

ii. SGPA < 1.50 in any semester (1 Academic Probation), and 1.5 ≤ SGPA < 2.00 in any two semesters. (2 Academic Warnings)

iii. 1.5 ≤ SGPA < 2.00 in any four semester. (4 Academic Warnings)

Academic Concession

A student who has missed a WE or any other course requirements because of illness or other compelling reason may appeal with supporting documents to the Dean of the Faculty for an Academic Concession for consideration of the Senate. In case of a written examination (WE), the student should submit an application with supporting documents within the time period specified under the clause on Absence from Examination of By-Law No. 15: Conduct of Examination from the date of an examination. In instances where a student misses any other course activity (CA), the student should submit the application with supporting documents before the last date of academic activities of the relevant Semester.

The applications forms for consideration of absence from end of semester examinations on medical ground are available with the Senior Assistant Registrar (SAR), Examination Division. Note that you have to inform the SAR, Examination via a Registered Letter as soon as possible after your absence from an examination. Also you need to furnish medical certificates from University Medical Officer or a qualified medical officer together with your application form.

The Senate of the University takes the final decision regarding applications for academic concession.

Dean’s List

A student who obtains a Semester Grade Point Average of 3.80 or greater in any Semester and has no I or F grades for any module either GPA or Non-GPA, will be recommended by the Board of Examiners to be included in the Dean’s List and such a placement will also be noted in the student’s Academic Transcript. For Semester 6, in addition to the above requirements, a candidate should have earned a minimum grade of A– for Industrial Training in order to be recommended for the Dean's List. A disciplinary action against a student disqualifies the candidate from being included in the Dean's List.

Graduation Requirements

A candidate should satisfy a total of 150 credits, including a minimum of 135 GPA credits and a minimum of 12 non-GPA credits from among the modules specified for Electrical Engineering specialization, in order to be admitted to the BSc Engineering Honours in Electrical Engineering degree.

The curriculum approved for the Electrical Engineering stream is given in the Tables Page 27 onwards. The curriculum indicates, compulsory (C), elective (E) and optional (O) modules along with their respective credit loading, either GPA or Non-GPA, recommended for each semester of the undergraduate course. Note that the approved curriculum includes 4 GPA credits from two non-technical modules which are compulsory. A minimum Overall GPA of 2.00 is necessary for graduation.

Award of Classes

Awarding of Classes is determined after the completion of all the graduation requirements by a candidate. A candidate becomes eligible for award of a Class only if he/she completes the graduation requirements within five academic years. The Overall GPA of a candidate will be used for awarding of Classes as in the Table below.

Overall GPA	Academic Standing
3.70 or above	First Class
3.30 – 3.69	Second Class Upper Division
3.00 – 3.29	Second Class Lower Division
2.00 – 2.99	Pass

Department Awards

The Department of Electrical Engineering presents two awards every year to the graduands on the basis of their overall academic performance. The details of which are as follows.

i. The Gold Medal is awarded to the Electrical Engineering graduand who has obtained the highest Class Average of not less than 3.80 GPA at the B.Sc. Engineering degree Final Examination, donated by Professors Samarajeewa Karunaratne, Rohan Lucas, Priyantha Wijayatunga and Ranjit Perera. This is awarded at the General Convocation.

ii. Professor Ted Parish Award is awarded to the Electrical Engineering graduand who has obtained the highest Class Average of not less than 3.70 GPA at the B.Sc. Engineering degree Final Examination, donated by Professor Ted Parish – a former UN Expert. Awarded only in years when no one qualifies for the Gold Medal and is awarded at the General Convocation.

iii. EESoc award for the best Electrical Engineering undergraduate project is awarded to the group of students whose undergraduate project is selected by the Department as the best project in the year. This is donated by the Electrical Engineering Society (EESoc) and awarded at the Academic Award Ceremony of the University of Moratuwa.

Curriculum – B.Sc. Engineering Honours in Electrical Engineering

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 1										
MA1013	Mathematics	C	3.0	1/1	3.0				20	80
CS1032	Programming Fundamentals	C	2.0	3/1	3.0				20	80
ME1032	Mechanics	C	2.0	3/4	2.0				20	80
MT1022	Properties of Materials	C	2.0	3/4	2.0		15.0		20	80
CE1022	Fluid Mechanics	C	2.0	3/4	2.0				20	80
EE1012	Electrical Engineering	C	2.0	3/4	2.0				20	80
EL1012	Language Skill Enhancement I	C	-	3/1	1.0				20	80
MN1012	Engineering in Context	C	2.0	-		1.0		1.0	30	70
				Total for Semester 1			**15.0**	**1.0**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 2										
MA1023	Methods of Mathematics	C	3.0	-	3.0		17.5		30	70
EE2093	Theory of Electricity	C	2.0	-	2.0				30	70
EN1802	Basic Electronics	C	2.0	3/4	2.0				40	60
EN1052	Introduction to Telecommunications	C	2.0	-	2.0				40	60
CS2812	Visual Programing	C	1.0	3/1	2.0				60	40
CS2842	Computer systems	C	2.0	-	2.0				40	60
ME1802	Introduction to Manufacturing Engineering	C	2.0	3/2	2.5				30	70
EE1193	Laboratory Practice I	C	-	3/1	1.0				100	0
EL1022	Language Skill Enhancement II	C	-	6/1	1.0				30	70
EE1963	Engineering Skill Development	C	1.0	6/1		1.5		1.5	100	0
DE1xxx	Humanities Elective I	E			2.0		2.0		30	70
MN1030	Entrepreneurship Skill Development (continuing)	O	0.5	3/2		1.0			100	0
Total for Semester 2							**19.5**	**1.5**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 3										
MA2013	Differential Equations	C	2.0	-	2.0		18.0		30	70
MA2023	Calculus	C	2.0	-	2.0				30	70
EE2043	Electrical Measurements and Instrumentation	C	2.0	-	2.0				30	70
EE2063	Electromagnetic Field Theory	C	2.0	-	2.0				30	70
EN2012	Analog Electronics	C	2.0	3/2	2.5				30	70
EN2022	Digital Electronics	C	2.0	3/2	2.5				30	70
ME2012	Mechanics of Materials I	C	1.5	3/2	2.0				30	70
CE1822	Aspects of Civil Engineering	C	2.0	-	2.0				30	70
EE2183	Laboratory Practice II	C	-	3/1	1.0				100	0
EE1953	Engineering Design	C	2.0	3/1		1.5		1.5	100	0
MN1030	Entrepreneurship Skill Development	O	0.5	3/2		1.0			100	0
Total for Semester 3							**18.0**	**1.5**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 4										
MA2033	Linear Algebra	C	2.0	-	2.0		16.0		30	70
MA2053	Graph Theory	C	2.0	-	2.0				30	70
EE2013	Circuit Theory	C	2.0	-	2.0				30	70
EE2023	Electrical Machines and Drives I	C	2.0	-	2.0				30	70
EE2033	Power Systems I	C	2.0	-	2.0				30	70
EE2193	Laboratory Practice III	C	-	3/1	1.0				100	0
ME2842	Basic Thermal Sciences and Applications	C	2.5	3/2	3.0				30	70
EE3203	Individual Project	C	-	-	2.0				100	0
EE3953	Communication and Presentation Skills	C	1.5	-		1.5		1.5	100	0
DE2xxx	Humanities Elective II	E	-	-	2.0		2.0		30	70
MN2010	Entrepreneurial Leadership	O	1.5	3/2	2.0				30	70
Total for Semester 4							**18.0**	**1.5**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 5										
MA3013	Applied Statistics	C	2.0	-	2.0		19.0		30	70
MA3023	Numerical Methods	C	2.0	-	2.0				30	70
MN3042	Business Economics and Financial Accounting	C	3.0	-	3.0				30	70
MN3052	Industrial Management and Marketing	C	3.0	-	3.0				30	70
EE2053	Control Systems I	C	2.0	-	2.0				30	70
EE3073	Electrical Installations I	C	2.0	-	2.0				30	70
EE2073	Electrical Machines and Drives II	C	2.0	-	2.0				30	70
EE2083	Power Systems II	C	2.0	-	2.0				30	70
EE3183	Laboratory Practice IV	C	-	3/1	1.0				100	0
MN3010	Multidisciplinary Design, Innovation and Venture Creation	O	1.5	3/2	2.0				30	70
Total for Semester 5							**19.0**	**0.0**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Training (20 weeks)										
EE3993	Industrial Training	C	-	-		6.0		6.0	100	0
				Total for Industrial Training				**6.0**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 6										
EE3063	Energy Systems	C	2.0	-	2.0		8.0		30	70
EE4013	Automation and Control Technologies	C	2.0	-	2.0				30	70
EE4033	Electrical Installations II	C	2.0	-	2.0				30	70
EE4073	Computer Aided Design and Simulation	C	2.0	-	2.0				30	70
				Total for Semester 6			**8.0**	**0.0**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 7										
EE3013	High Voltage Engineering I	C	2.0	-	2.0		16.0		30	70
EE3023	Control Systems II	C	2.0	-	2.0				30	70
EE3033	Electrical Machines and Drives III	C	2.0	-	2.0				30	70
EE3043	Power Systems III	C	2.0	-	2.0				30	70
EE3053	Power Electronics and Applications I	C	2.0	-	2.0				30	70
EE4203	Design Project	C	-	-	5.0				100	0
EE4183	Laboratory Practice VI	C	-	3/1	1.0				100	0
EE4903	Field Visit	C	-	6/2	-	1.0		1.0	100	0
EE4243	Nuclear Power Engineering	E	2.0	-	2.0		2.0		30	70
EE4213	Robotics and Mechatronics	E	2.0	-	2.0				30	70
MN4042	Technology Management	E	2.0		2.0		2.0		30	70
MN4022	Engineering Economics	E	2.0		2.0				30	70
MN3020	Entrepreneurship Business Basics	O	2.0	3/1	3.0				30	70
MN4030	Strategic Enterprise Management	O	1.5	3/2	2.0				30	70
Total for Semester 7							**20.0**	**1.0**		

Module Code	Module Name	Cat-egory	Hours per week		Credits		Norm†		Evaluation (%)	
			Lec-tures	Lab/ CA‡	GPA	NGPA	GPA	NGPA	CA	WE
Semester 8										
EE4023	High Voltage Engineering II	C	2	3/2	2.0		14.0		30	70
EE4043	Electrical Machines and Drives IV	C	2.0	-	2.0				30	70
EE4053	Power Systems IV	C	2.0	-	2.0				30	70
EE4063	Power Electronics and Applications II	C	2	-	2.0				30	70
EE4203	Design Project	C	-	-	5.0				100	0
EE4193	Laboratory Practice VII	C	-	3/1	1.0				100	0
EE4223	Renewable Energy and Environment	E	2.0	-	2.0		2.0		30	70
EE4233	Real-time Computer Systems	E	2.0	-	2.0				30	70
MN4072	Small Business Management & Entrepreneurship	E	2.0	-	2.0		2.0		30	70
MN4092	Management Skills Development	E	2.0	-	2.0				30	70
MN4122	Human Resource Management & Industrial Relations	E	2.0	-	2.0				30	70
MA4023	Operations Research	O	2.0	-	2.0				30	70
MA4033	Time Series & Stochastic Process	O	2.0	-	2.0				30	70
MN4010	Business Plan Development	O	2.0	3/1	2.0				30	70
MN4170	Global Entrepreneurship	O	2.0	3/1	2.0				30	70
MN4112	Production and Operations Management	O	2.0	-	2.0				30	70
	Total for Semester 8						**18.0**	**0.0**		
	From Optional Modules (any semester)						**2.0**	**0.0**		
	Total for the Program						**137.5**	**12.5**		

C/E/O Compulsory/Elective/Optional

†Norm Recommended credit load for each semester. The actual load may vary within faculty stipulated limits, depending on the student preference.

‡Lab/CA *n/m* indicates *n*-hours repeated every *m*-weeks of Laboratory or Continuous Assessment.

Credit requirement for the Entrepreneurship minor

Module Code	Module Title	Cat-egory	Lec-ture (hrs)	Lab/ Assign-ment (hrs)	Credit Load	Credit Required		Evaluation (%)	
						GPA	NGPA	CA	WE
MN1020	Entrepreneurship Skill Development (deliver over two semesters)	C	15	45	2.0	-	2.0	100	0
MN2010	Entrepreneurial Leadership	C	22	22	2.0	2.0		30	70
MN3010	Multidisciplinary Design, Innovation and Venture Creation	C	22	22	2.0	2.0		30	70
MN3020	Entrepreneurship Business Basics	C	30	45	3.0	3.0		30	70
MN4010	Business Plan Development	C	22	22	2.0	2.0		30	70
MN4022	Engineering Economics	E	30	-	2.0			30	70
MN4042	Technology Management	E	30	-	2.0			30	70
MN4112	Production and Operations Management	E	30	-	2.0			30	70
MN4030	Strategic Enterprise Management	E	22	22	2.0			30	70
MN4170	Global Entrepreneurship	E	22	22	2.0	2.0		30	70
					Total credits required	**11.0**	**2.0**		

Special Modules

The curriculum of the Electrical Engineering degree programme consists of the following special modules which have been designed to enhance hands-on experience of undergraduates in dealing with engineering projects, team skills and exposure to electrical engineering industry in Sri Lanka.

Engineering Design and Skill Development

These modules help develop, among other skills, teamwork, innovation, choice of materials, survey skills, pricing and marketing skills and manufacturing through a simple engineering design. The creativity in engineering design process is brought out by allowing students to participate in small design groups. Each group identifies a significant engineering problem, proposes a solution and then proceeds to demonstrate feasibility of their solution through construction of a prototype. Students will gain knowledge of basic engineering tools such as workshop, drawing, AutoCAD, PSpice etc. in this process.

Laboratory Practice

Each Semester except Semester 6 consists of one compulsory module of Laboratory Practice where students will be performing the laboratory experiments relevant to the electrical engineering subjects of that Semester. While there is no end-of-semester written examination, the final grades will be calculated by totalling the individual marks earned by you for each practical session. Note that the marks earned with respect to different experiments will not be considered as part of continuous assessment marks of the relevant subject modules.

Humanities Electives

All students in Electrical Engineering are expected to offer 4 GPA credits of non-technical subjects on Humanities, generally two modules each in Semesters 2 and 4. Various academic Departments of the Faculty of Engineering arrange modules in the general areas of art, performing arts, social sciences, religion, languages and general interests. Since the registration is allowed only for limited numbers on a first come first serve basis, students are advised to select their preferences well in advance. Students in Electrical Engineering will get first preference for subjects offered by this Department.

Individual Project

In this Semester 4 module the students will design an engineering product or a system individually and independently taking technical, financial, environmental and social requirements into consideration. The assessment is based on a presentation of the results and a project report.

Industrial Training

In between Semester 5 and Semester 6 of the undergraduate programme all students are assigned 20 weeks of compulsory Industrial Training. The training placements are arranged by the Department so that every student gets an opportunity of training at the Ceylon Electricity Board or Lanka Electricity Company and at one other industry related to Electrical Engineering. The Industrial Training module is assessed via a viva voce and a written report. This module is a mandatory requirement of the Degree programme and is worth 6 non-GPA credits.

Industrial Training is meant to provide hands-on technical training related to the industry. Both public and private sector organizations in electrical power generation, transmission, utilization and IT, provide industrial training to Electrical undergraduates. Some such partners who provide training opportunities in addition to Ceylon Electricity Board and Lanka Electricity Pvt. Company Limited are Lanka Transformers Ltd., Airport and Aviation Authority, Ports Authority, Nikini Automation Pvt. Ltd., Ace Power Ltd, and Lakdhanavi Ltd.

During this period, the students learn how the theoretical principles learnt in the class room could be applied in practical situations and learn what skills, knowledge and attitudes would be required for an effective start of the engineering profession. The students will work with different categories of people in an industrial environment adopting to appropriate technical, environmental, economic and social constraints. Furthermore they will acquire knowledge of organizational, financial and human resources management.

Upon completion of this module, the students submit an individual report detailing the experience gained during training and faces an interview for assessment and feedback. Evaluation of the training report is carried out by the Industrial Training Division of the Faculty of Engineering. The staff of the Department contributes to the evaluation process by conducting visits to training places to observe the performance of the trainees and also by being a member of the interview panel.

Field Visit

The curriculum also contains a Field Visit module, generally in Semester 7, which is directly related to the industrial exposure of students in addition to the compulsory module on Industrial Training. The aim is to provide an opportunity for the students to observe the field implementation of specific electrical engineering projects and processes around the country. Due to the limited time of a visit and the large number of students taking part, the opportunity for hands-on experience is limited. However they get the opportunity to observe the most recent and state of the art power projects being implemented in Sri Lanka.

Field visits are generally 1-2 days in duration and the university provides transport free of charge while the incidental expenses need to be borne by the students.

After the visit, each student is expected to prepare a technical report on the place she/he visited. The report will be evaluated by the module coordinator and a grade will be awarded. The field visits conducted recently include visits to Ace Power Pvt. Ltd. (100 MW Diesel power plant, Embilipitiya), Upper Kothmale Hydro Power Project (150 MW run–of–the–river hydroelectric plant and Wind power Plant, Puttalam, 300 MW Puttalam Lakvijaya Coal Plant, Norochcholai).

Design Project

Each student is required to acquire ten (10) credits from the compulsory Design Project, normally undertaken as a joint project with four students in each group during Semesters 7 & 8 of the undergraduate programme.

The group is expected to function as a coherent product development team, and the members are encouraged to plan and implement their own management structure within

the team. The different functions are rotated, so that each student has an opportunity to acquire and demonstrate varied skills required for the overall success of the project. These include design, creativity, problem solving, innovation and management. Other skills such as those of language, communication and presentation (both written and verbal), public relations etc. are also important for the successful completion of the Design Project.

Design Project is evaluated continuously throughout the two semesters via progress review presentations. At the end of the module, the final evaluation is done through viva-voce and demonstration of your project achievements/implementations.

Detailed Syllabi – Electrical Engineering

Semester 1

Module Code	**MA1013**	Module Title	**Mathematics**			
Credits	**3.0**	Hours/Week	Lectures	**3.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**1/1**		

Module Objectives

1. To cultivate the perspectives and the analytical skills required for efficient use, appreciation, and understanding of mathematics.
2. To develop the ability to read, communicate, and understand mathematical ideas in a variety of settings, both verbally and in writing, making use of numerical, graphical, and symbolic viewpoints.
3. To obtain a well-rounded introduction in the areas of Logic and Set theory, Matrix algebra, Vectors and Real analysis and apply them in engineering applications.

Learning Outcomes

After completing this module, the students should be able to

1. use discrete mathematical structures such as Logic and Set Theory in applications.
2. use algebraic structures such as Real Numbers, Vectors and Matrices in applications.
3. apply the basic concepts of limits, differentiation and integration in engineering applications.

Outline Syllabus

1. Logic and Set Theory
   Propositions, truth tables, symbolic statements, conditional connectives, quantifiers; Techniques of proof: Direct, contradiction, induction, pigeon-hole principle; Sets, cardinality, Cartesian product, ordered pairs; Relations, functions, Boolean algebra: Disjunctive and conjunctive normal forms, logic gates, Karnaugh maps, minimization and applications.
2. Real Analysis
   Real number system, supremum and infimum, completeness axiom; Basic functions: Polynomial, exponential, trigonometric, hyperbolic and their inverses; Limit of a function, continuity, differentiability, derivatives; Rolle's theorem, mean value theorem, L' Hospital's rule; Sequences and series of real numbers; Tests for convergence of sequences and series.
3. Vectors, and Matrices
   Vector algebra, vector product, scalar product, scalar triple product, vector triple product; Equations of lines and planes; Matrix operations, transpose, adjoint and inverse of a matrix, echelon forms, rank, determinants; Systems of linear equations.

Module Code	**CS1032**	Module Title	**Programming Fundamentals**			
Credits	**3**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/1**		

Module Objectives

1. To be able to understand the building blocks of a computer system.
2. To be able to write a computational algorithm to solve an engineering problem.
3. To be able to implement a complex computational algorithm in a high level computer programming language.

4. To understand the fundamental principles of user interface design.

Learning Outcomes
After completing this module, the students should be able to
1. device algorithms to solve given problems.
2. develop programs from algorithms using main features of a high level programming language such as C.
3. use an Integrated Development Environment.

Outline Syllabus
1. Structure of a computer system
2. Algorithms
3. Programming in C
   - Data Types
   - Control Structures and iteration
   - Modularity and functions
   - Input, output and file handling
   - Structures and arrays
   - Efficiency and performance
   - Problem solving with programs
4. User-interface design

Module Code	**ME1032**	Module Title	**Mechanics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/4**		

Module Objectives
1. Understand plane areas
2. Understand kinematics of particles and rigid bodies
3. Understand the forces in assemblies
4. Understand mechanical vibrations

Learning Outcomes
After completing this module, the students should be able to demonstrate
1. the ability to calculate rigid body forces and motions
2. the ability to perform simple mechanics experiments
3. the understanding of the basic concepts of dynamics
4. the ability to model and solve basic systems in dynamics.

Outline Syllabus
1. Properties of plane areas.
2. Internal forces and principle of superposition.
3. Determination of forces in assemblies of rigid bodies.
4. Kinematics of particles and rigid bodies, 2D link mechanisms.
5. Kinetics of particles and rigid bodies, work and energy methods.
6. Mechanical vibrations (Free vibrations of single degree of freedom systems).

Module Code	**MT1022**	Module Title	**Properties of Materials**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/4**		

Module Objectives

1. To be able to recognize and to compare the structure of materials and to assess the properties of engineering materials.

Learning Outcomes

After completing this module, the students should be able to

1. recognize the structure of metals, polymers and ceramics.
2. identify the relationships between the structure of materials and their properties.
3. assess the properties of engineering materials.

Outline Syllabus

1. Structure of atoms, atomic theories, atomic bonding in materials.
2. Crystal structures and defects.
3. Structure-property relationships.
4. Mechanical properties of materials.
5. Electrical properties of materials.
6. Chemical properties of materials.
7. Radioactivity and nuclear properties.

Module Code	**CE1022**	Module Title	**Fluid Mechanics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/4**		

Learning Outcomes

After completing this module, the students should be able to demonstrate the ability to

1. calculate static fluid forces & solve problems in Fluid Statics
2. analyse problems in fluid flow by continuity, energy & momentum considerations.

Learning Outcomes

After completing this module, the students should be able to demonstrate the ability to

1. calculate static fluid forces & solve problems in Fluid Statics
2. analyse problems in fluid flow by continuity, energy & momentum considerations

Outline Syllabus

1. Properties of Fluids
2. Hydrostatic Pressure
3. Hydrostatic Thrust on Submerged Surfaces
4. Buoyancy
5. Introduction to Fluids in Motion
6. Continuity Equation and its Applications
7. Bernoulli's Equation and its Applications

Module Code	**EE1012**	Title	**Electrical Engineering**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Tutorials	**3/4**		

Module Objectives

1. To work with SI units in engineering applications
2. To obtain an overview of electrical engineering and to obtain the basic analysis tools in electrical engineering.
3. To obtain transient solutions in simple electrical engineering problems.
4. To analyse and solve alternating current problems.
5. To select and use instruments in electrical engineering
6. To assist in the wiring of a domestic electrical installation

Learning Outcomes

After completing this module the students should be able to

1. use correct SI units.
2. project an overall picture of Electrical Engineering.
3. perform DC, AC and transient calculations.
4. apply different types of meters for electrical measurements.
5. draw up complete wiring circuit of a household and appreciate the importance of different protection.

Outline Syllabus

1. SI Units.
2. Overview of Electrical Engineering.
3. Basic DC circuit analysis: Circuit elements, circuit laws, circuit solutions.
4. Transient solution of simple RLC circuits.
5. AC Theory: Phasor representation, complex representation, impedance, admittance, complex power and energy, power factor, AC circuit calculations.
6. Electrical Measurement: Moving coil, moving iron and rectifier type meters, bridge methods, power and energy meters, working principles.
7. Electrical Installations: Fuses, MCBs, ELCBs, wires, complete household wiring circuit.

Module Code	**EL1012**	Module Title	**Language Skills Enhancement I**			
Credits	**1.0**	Hours/Week	Lectures	**–**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/1**		

Module Objectives

1. To be able to acquire basic English language skills required to, assimilate the knowledge they would require to become competent engineers as undergraduates and to effectively function as engineers after they graduate.

Learning Outcomes

After completing this module, the students should be able to

1. read and comprehend subject related texts.
2. demonstrate the ability to understand and write the gist of a subject related text.
3. demonstrate the ability to understand and express the content of a text in his/her own words.

4. illustrate or develop an idea in writing coherently and logically. 5. demonstrate the ability to participate in a subject related discussion.
Outline Syllabus 1. Subject related texts. 2. Précis. 3. Paraphrase. 4. Writing paragraphs. 5. Group discussions.

Module Code	**MN1012**	Module Title	**Engineering in Context**			
Credits	**1.0**	Hours/Week	Lectures	**1.0**	Pre-requisites	**None**
GPA/NGPA	**NGPA**		Lab/Assignments	–		
Module Objectives 1. To develop the basic skills, ethics required for an engineer.						
Learning Outcomes After completing this module, the students will be able to 1. recognize the scientific and social contexts in engineering profession. 2. identify the basic ingredients of professionalism in engineering. 3. explain the importance of economic, risk and safety issues for the engineering decisions. 4. describe the basic professional skills, ethics and concepts required for an engineer in industrial society.						
Outline Syllabus 1. What is engineering and its relevance to society. Historical development of engineering and Sri Lankan engineering heritage (old and recent). 2. Economic, risk and safety issues in engineering. Roles and responsibilities of a professional engineer in society and industry. 3. Interaction of engineering with natural and built environment; Engineering solutions for environmental problems. 4. Sustainable engineering design, learning from failures. 5. Skills of engineer in industrial environment (management, teamwork, communication).						

Semester 2

Module Code	**MA1023**	Module Title	**Methods of Mathematics**			
Credits	**3.0**	Hours/Week	Lectures	**3.0**	Pre-requisites	**MA1012**
GPA/NGPA	**GPA**		Lab/Tutorial	**-**		

Module Objectives

1. To understand the principles of solving non-linear equations, ordinary differential equations and numerical integration.
2. To apprehend the methodologies of applying multivariate calculus, statistics and probability distribution to solve real engineering problems.

Learning Outcomes

At the end of this module the student should be able to

1. solve a non-linear equation in a single variable, to a desired accuracy.
2. integrate a function of a single variable numerically, to a desired accuracy.
3. solve first order non-linear ordinary differential equations.
4. solve initial value problems involving second order linear ordinary differential equations.
5. apply multivariate calculus to solve simple engineering problems.
6. apply statistical skills in engineering problems.
7. use probability distributions for decision making in engineering.

Outline Syllabus

1. Numerical Methods
   Algorithms and errors; Numerical solution of non-linear equations. Bisection and false position methods, simple iterations. Newton-Raphson method; Estimation of errors and acceleration of convergence. Approximations of functions; Numerical integration; Trapezoidal rule, Simpson's rule.
2. Ordinary Differential Equations and Multivariate Calculus
   Reimann integration; First order ordinary differential equations: Variable separable, homogeneous and exact equations; Second order differential equations: Reducible forms; Functions of several variables: partial differentiation, chain rule, directional derivatives; Maxima and minima, Lagrange multipliers; Taylor series expansion of multivariate functions.
3. Basic Probability and Statistics
   Conditional probability, Bayes' theorem; Discrete and continuous random variables. Probability and cumulative distribution functions, joint distribution functions. Uniform, Binomial, Poisson and Normal distributions and their applications. Basic statistical indicators in data analysis, correlation coefficients; Introduction of Minitab - statistical software.

Module Code	**EE2093**	Module Title	**Theory of Electricity**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisite	**EE1193**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To develop analysis tools in electrical engineering and to analyse electrical circuits and waveforms using the tools.
2. To Introduce the fundamental concepts and to develop analytical skills for the under-

standing and application of basic electrical principles.
3. To apply DC and AC electrical principles to electrical circuit networks.
4. Basic network theorems and methods of analysis are combined with complementary laboratory exercises to provide a solid working foundation in electrical fundamentals.

Learning Outcomes
After completing this module the student should be able to
1. solve coupled circuits involving mutual impedance and/or resonance phenomena.
2. apply network theorems in solving circuits.
3. solve circuits containing three phase generators and loads.
4. analyse circuits with non-sinusoidal voltage and current waveforms.

Outline Syllabus
1. Review of fundamentals
   Fundamentals of electric circuits, DC circuit analysis, Transient solutions of RLC circuits using differential equations, AC theory.
2. Coupled circuits and Dependent sources
   Series and parallel resonance, mutual inductance, electromagnetic coupling in circuits, analysis of coupled circuits, transformer as a coupled circuit; Dependent sources, solving of circuits in the presence of dependent sources.
3. Network theorems
   Superposition, Thevenin's, Norton's, Millman's, Reciprocity, maximum power transfer, Nodal-mesh transformation and compensation theorems. Network topology, Nodal and mesh analysis. Two-port theory: Impedance, admittance, hybrid and ABCD parameters.
4. Three-phase Analysis
   Analysis of three phase balanced circuits and unbalanced circuits, symmetrical components, Single line equivalent circuits.
5. Non-sinusoidal waveforms
   Waveform parameters: rms, peak, rectified average etc., power, harmonics, Fourier analysis, Laplace transform, transient analysis using the Laplace transform.

Module Code	**EN1802**	Module Title	**Basic Electronics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/4**		

Module Objectives
1. To learn about different semiconductor devices, their construction, characteristics, selection, performance and their use in electronics circuits and in engineering applications.

Learning Outcomes
At the end of the module the student will be able to
1. Describe basic principles of operation of semiconductor devices.
2. Use diodes and transistors in simple electronic circuits.
3. Use operational amplifiers in simple amplifier applications.
4. Use logic gates to design simple combinational logic circuits.

Outline Syllabus
1. Introduction
   Historical aspects, practical electronic systems, electronic industry, practical aspects of passive components, manufacturing electronic products, software tools.

2. Materials Used in Electronics
   Introduction to semiconductors and their basic properties, modern electronic materials.
3. Diodes, Diode Circuits and Applications
   Operation and characteristics of junction diode, zener diode, varactor diode and light emitting diode, rectification, clamping and limiting circuits, thyristors and controlled rectification.
4. Bipolar Junction Transistors (BJTs) and Circuits
   Operation and characteristics of BJT, use as a switch and as an amplifier, biasing schemes, amplifier configurations and parameters.
5. Field Effect Transistors (FETs) and Circuits
   Operation and characteristics of JFET, use as a switch and as an amplifier, comparison with BJTs.
6. Integrated Circuit Amplifiers
   The need for integration, operational amplifiers, inverting amplifier configuration of op amp, monolithic audio IC amplifiers.
7. Logic Gates and Circuits
   Logic gates and Boolean algebra, minimization of logic expressions, combinational logic circuits, introduction to sequential logic circuits, design of simple logic circuits.

Module Code	**EN1052**	Module Title	**Introduction to Telecommunications**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To enable students to gain knowledge of the basics of telecommunication theory and systems.

Learning Outcomes

At the end of the module the student will be able to

1. explain basic concepts related to communication systems.
2. differentiate between analog and digital communications principles.
3. describe basic aspects of a computer network.
4. differentiate between network topologies and types of networks.
5. discuss the operation of end user equipment in communications.

Outline Syllabus

1. Introduction to Telecommunication Systems
   Historical developments and current trends.
2. Elementary Concepts in Telecommunications
   Digital and analog signals, Types of communication channels, Bandwidth and filtering, The effect of bandwidth and noise on signals, The radio spectrum and wave propagation, Modulation.
3. Transmission
   Guided and unguided transmission, multiplexing, Transmission networks, Multiplexing hierarchies for high speed communication networks.
4. Access Networks
   PSTN, DSL, Wireless local loop, Mobile.
5. Switching and Signaling
   Hierarchical networks, teletraffic concepts.
6. Networking Principles

Topologies, Types of networks, layered architecture, Internetworking, Security including Public Key Encryption.

7. Telecommunication Devices
   Telephone instrument, Radio receiver, TV receiver, Modems, cellular phones etc.

Module Code	**CS2812**	Module Title	**Visual Programming**			
Credits	**2.0**	Hours/Week	Lectures	**1.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/1**		

Module Objectives

1. To be able to use an integrated development environment for visual programming in a high level language.

Learning Outcomes

After completing this module, the students should be able to

1. Develop a working program for specified programming problem using a visual programming environment.

Outline Syllabus

1. Introduction to the concept of visual programming.
2. Introduction to visual programming environments.
3. Practice of visual programming using .NET Framework
   Objects, Properties, Events and Methods; Variables, Data Types and Controls; Use of Forms and Controls to create User Interfaces; Program Control Flow; String and file manipulation; Arrays; Procedures and Functions; Exception Handling; Database Programming

Module Code	**CS2842**	Module Title	**Computer Systems**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To obtain a working knowledge of the lower levels of abstraction of a computer system.

Learning Outcomes

At the end of the course, a student will have an understanding of

1. the representations used for numbers and text, computer arithmetic,
2. the functions of the components of a CPU, how main memory is organised,
3. the architecture of the Pentium microprocessor, models for input/output.

Practical skills will be developed in particular, in developing assembly programs for the Pentium microprocessor.

Outline Syllabus

1. Introduction
   Relationship to other courses, levels of abstraction, instruction set level, hardware design level, role of the computer architect.
2. Data representation
   Binary numbers, arithmetic, octal, hex, base conversion, sign and magnitude, 1's complement and 2's complement, BCD, overflow, characters, ASCII/Unicode. Floating

point numbers: conversion, normalisation, arithmetic operations, overflow/underflow representation errors, IEEE standard format, NANs, Infinity and denormalised values.

3. Memory Organisation
   Registers, RAM, disks; byte and word addressing; byte ordering, alignment, banks and interleaving.
4. CPU organisation and operation
   Components of a simple CPU, instructions, machine code, fetch-execute cycle, simple assembly programming.
5. Pentium architecture
   Programming model, registers, memory models, addressing modes, arrays, records, instructions, expressions, loops, procedures.
6. Input and output
   Device types and characteristics, controllers, ports, programmed I/O, interrupts, DMA, Pentium interrupt model, traps and exceptions, simple device drivers.
7. Operating Systems Introduction
   Objectives and functions, layers and views, user interfaces, as a resource manager, processes.
8. Process Management
   States and representation, creation and termination, processes and threads.
9. Process Scheduling
   Scheduling and dispatching, algorithms Concurrency and Synchronisation: mutual exclusion, deadlocks, starvation, locks, semaphores, monitors.
10. Memory Management
    Linking & loading, fixed and dynamic partitioning, fragmentation, virtual memory, paging, segmentation.

Module Code	**ME1802**	Module Title	**Introduction to Manufacturing Engineering**			
Credits	**2.5**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/2**		

Module Objectives

1. To develop basic skills needed for manufacturing.
1. To acquire knowledge of basic theory needed for manufacturing.

Learning Outcomes

After completing this module, the students should be able to

1. explain the mechanics of machining processes, and their applications for different operations.
2. make a proper selection of manufacturing materials and tool materials for a given manufacturing process.
3. select the best machining operation(s), and plan out optimum machining process(es) for same.
4. use the principles of engineering metrology to assure quality of products.

Outline Syllabus

1. Overview of manufacturing engineering in the present context,
2. Introduction to selected manufacturing processes
   Casting, Fabrication, Hand tools and their importance.
3. Introduction to machining operations
   Classification of machining operations and machine tools, Mechanics of Machining,

Mechanics of chip formation, types of chips, Built-up-Edge, Tool life, Surface finish, integrity, Cutting forces and power.

4. Engineering materials and tool materials
   Selection of work-piece materials and tools, correlating them to process and each other.
5. Detailed study of principal machining processes
   Machines and Tools used, Sawing, Drilling, Boring, Reaming, Tapping, Lathe, Shaper, Milling, Grinding, Abrasive machining, Finishing, Planing, Broaching, Gear manufacture etc.
6. Introduction to Numerical Control (NC) and Computer-Aided Design & Manufacturing (CAD/CAM).
7. Surface treatment and finishing
   Painting, Galvanizing, Cold galvanizing, Epoxy coating, Electroplating, etc., Powder spray technology and its use as a refilling and repair technology.
8. Engineering metrology and instrumentation
   Basic measuring instruments in precision metrology, Tolerances, Limits and fits, Measurement of surface texture and geometric errors, Coordinate measuring machine, Advanced measuring instruments.

Module Code	**EE1193**	Module Title	**Laboratory Practice I**			
Credits	**1.0**	Hours/Week	Lectures	**None**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. use instruments correctly and appropriately for measuring electrical quantities.
2. appreciate and apply electrical safety procedures.
3. demonstrate knowledge of elementary electrical devices which are based on electromagnetic and electrostatic principles.

Outline Syllabus

This module consists of Semester 2 Electrical Engineering Laboratory experiments in the areas of,

1. Electrical measurements
2. Electric circuits
3. Electrostatic fields
4. Electromagnetic fields

One experiment may cover more than one of the above areas and would be conducted as part of a system of electrical engineering applications.

Module Code	**EL1022**	Module Title	**Language Skills Enhancement II**			
Credits	**1.0**	Hours/Week	Lectures	**–**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**6/1**		

Module Objectives
1. To enable students to acquire advanced English language skills required to effectively function as electrical engineers.

Learning Outcomes
After completing this module, the students will be able to
1. contribute to a group project through discussion and other related work.
2. make a short presentation on a subject related topic.
3. describe a simple process.

Outline Syllabus
1. Group projects.
2. Training in presentation skills.
3. Reinforcing writing skills.

Module Code	**EE1963**	Module Title	**Engineering Skill Development**			
Credits	**1.5**	Hours/Week	Lectures	**1.0**	Pre-requisites	
GPA/NGPA	**NGPA**		Lab/Assignment	**6/1**		

Module Objectives
1. To acquire knowledge and skills on the use of software for drawings, analogue and digital circuit simulation, and solving equations using matrix manipulation.

Learning Outcomes
After completing this module the student should be able to
1. model and construct simple products based on the knowledge and skills of AutoCAD, PSPICE, drawing and workshop.

Outline Syllabus
1. Use of basic skill development tools: AutoCAD, PSpice, workshop, drawing.
2. Group report and presentation on the use of skill development tools.

Module Code	**MN1030**	Module Title	**Entrepreneurship Skill Development**			
Credits	**1.0**	Hours/Week	Lectures	**0.5**	Pre-requisites	
GPA/NGPA	**NGPA**		Lab/Assignment	**3/2**		

Learning Objectives
1. To provide engaging, academically challenging and experimental learning sessions in economics and entrepreneurship education addressing the key concepts of: company structure, roles within a company, company capitalization, customer-product focus, product market pricing, company operations, product sales and company liquidation.

Learning Outcomes
At the end of this course students will be able to
1. Apply their business and entrepreneurial knowledge and skills to education, career and service pursuits

2. Recognize the significance of personal responsibility and financial literacy in making positive life decisions
Outline Syllabus 1. Discuss leadership position, business idea, company name, vision and mission, establish company values, company capitalization process. 2. Working as a company, students conduct officer elections and learn about each department's specific responsibilities during the operation and liquidation phases. 3. Students use tools such as market surveys and cost-benefit analysis to determine potential products for their target market and develop initial business plan. 4. Students host Board of Directors meeting to approve the company's Business Plan, review implementation strategies and accept the company Charter, sell shares. 5. Materials needed for production are ordered and the company business plan is implemented. 6. Learn about specific sales techniques during selling of their product/service. 7. Students hold department meetings to share best practices and propose changes to current company operations. 8. Begin to finalize production, access excess inventory, and prepare for the Board of Directors liquidation meeting. 9. Students explore steps and learn how to apply what they have learned as a company to personal entrepreneurial pursuits. 10. Final Board of Directors liquidation meeting and approve the Annual Report.

Semester 3

Module Code	**MA2013**	Module Title	**Differential Equations**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA1023**
GPA/NGPA	**GPA**		Lab/Tutorials	**–**		

Module Objectives

1. To understand the principles of Fourier Series, Fourier Transform, Laplace Transform and Partial Differential Equations.

Learning Outcomes

At the end of this module the student should be able to

1. apply Fourier series approximations for periodic functions in real world situations.
2. solve initial-boundary-value problems involving partial differential equations.
3. apply Laplace transform and Fourier transform methods to solve differential equations in engineering applications.

Outline Syllabus

1. Fourier Series approximation
   Fourier coefficients, Dirichlet's condition, odd and even function, half range series. Trigonometric approximation to discrete data.
2. Partial Differential Equations
   Classification of second-order partial differential equations. Solutions by separation of variables. Fourier series application to boundary value problems.
3. Laplace Transform and applications
   Laplace transform of elementary functions and some basic theorems on Laplace transform. Application of Laplace transforms to solution of differential equations and system of differential equations, transfer functions, convolution theorem, concepts of stability and controllabity.
4. Fourier Transform and applications
   Non-periodic function, Fourier transform, its properties and applications.

Module Code	**MA2023**	Module Title	**Calculus**			
Credits	**2.0**	Hours/ Week	Lectures	**2.0**	Pre-requisites	**MA1023**
GPA/NGPA	**GPA**		Lab/Tutorials	**–**		

Module Objectives

1. To understand the principles of Vector Calculus and Complex Variables.

Learning Outcomes

At the end of this module the student should be able to

1. perform vector differentiation and integration and evaluate vector and scalar quantities in various engineering applications.
2. apply divergence, stokes' and green's theorem in various situations.
3. apply cauchy's integral formula to solve engineering problems.
4. perform contour integration techniques.
5. apply conformal mapping in physical system modelling.

Outline Syllabus

1. Vector Calculus
   Vector differentiation and differential operators,space curves and line integral, surface

and surface integrals. Divergence theorem, Stroke's theorem, Greens theorem in plane. Some basic applications.

2. Complex Variables
   Analytical function and Cauchy-Reimann equation, Cauchy's integral formula and applications. Taylor and Laurent's series, contour integration. Introduction to conformal mapping.

Module Code	**EE2043**	Module Title	**Electrical Measurements and Instrumentation**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2193**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To develop capacity to make measurements on electrical and non-electrical quantities using the proper instruments, through an understanding of the underlying principles and practical aspects of measurements

Learning Outcomes

After completing this module the student should be able to

1. design analogue and/or digital instruments for electrical measurements.
2. use digital and/or analogue oscilloscope effectively.
3. analyse signals for measuring purposes.

Outline Syllabus

1. Sensors and Transducers
   Review of analogue instrumentation, null deflection methods, current and potential transformers. Types of sensors/transducers for measurements of physical quantities.
2. Sampled data systems
   Nyquist's sampling theorem, encoding, modulation, quantising, resolution, dynamic range, quantisation noise; Fourier analysis of sampled data, aliasing, antialiasing filters.
3. Digital instrumentation
   Analogue-to-digital conversion (ADC), digital-to-analogue conversion (DAC), real-time data acquisition, hardware and software for data acquisition, digital multimeters, data loggers.
4. Oscilloscope
   Analogue oscilloscope: electron deflection, time base generation, focusing, modes of operation; Digital oscilloscope: sample rate and bandwidth, data storage, display, on-screen measurements.
5. Statistical basis of measurements
   Statistical signal analysis, correlation, convolution, Kalman filtering.

Module Code	**EE2063**	Module Title	**Electromagnetic Field Theory**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisite	**EE1093**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To understand the principles of Electrostatic Fields and Electromagnetic Fields.
2. To understand Maxwell's formulation of Field Theory.
3. To learn basic Electrodynamics of charged particles.
4. To understand plane wave propagation in a uniform media.

Learning Outcomes
After completing this module the student should be able to

1. Solve electrostatic and electromagnetic field problems involving simple conductor configurations.
2. Apply fundamental concepts of electromagnetic waves and their relationship to electric circuits.

Outline Syllabus

1. Electrostatic theory
   Electric charge and electric field, Coulomb's law, Gauss's theorem and its use for electric flux density and electric field calculations, Electric potential due to charges, Laplace's and Poisson's equations, Solution to Laplace's equation for determining potential distribution, The interface between two dielectric media, Method of images, Capacitance of conductor configurations with two or more conductors, Energy in electric fields, Calculation of mechanical force due to electrostatic fields.
2. Electromagnetic theory
   Production and measurements of magnetic fields, Magnetic potential, Magnetomotive force, Biot-Savart and Ampere laws for calculating magnetic potential and flux density for simple conductor configurations, Magnetisation of iron, Design calculations for magnetic circuits, air-gap flux, flux leakage. Electromagnetic induction, Faraday's law, Energy in magnetic fields, Calculation of mechanical force due to magnetic fields.
3. Electrodynamics
   Motion of charged particles in the presence of electrostatic and electromagnetic fields.
4. Maxwell's equations
   The field equations in the quasi-stationary case, concepts of displacement current, the complete field equations in differential and integral forms, Maxwell's equations in the case of sinusoidal variations.
5. Plane electromagnetic waves
   Wave equation and its solution in the single dimensional case, plane waves in dielectric space with and without losses, concepts of wave impedance, impedance of empty space, power flow, Poyntin's theorem. Electromagnetic waves at boundaries, Continuity condition, Conditions at a perfect conductor, Electromagnetic waves in conductors.

Module Code	**EN2012**	Module Title	**Analog Electronics**			
Credits	**2.5**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/2**		

Module Objectives

1. To learn about the transistor circuits and study the characteristics of the circuits under the different frequency ranges.
2. To learn about different amplifies and use them in electronics circuits
3. To learn about Power Electronics devices and their applications in engineering context

Learning Outcomes
At the end of the module the student will be able to;

1. Examine the behaviour of BJT and FET amplifiers in low, mid and high frequency ranges.
2. Design transistor amplifiers to meet given specifications.
3. Explain the differential amplifying concepts.
4. Identify the functionality and applications of operational amplifier circuits.

5. Identify different power amplifier classes and their characteristics.
6. Perform power calculations for power amplifiers.
7. Identify power electronic devices, their construction, operation and applications.

Outline Syllabus

1. Analysis of transistor circuits
   Analysis of transistor circuits at DC, biasing circuits for BJTs and FETs, transistor as an amplifier, single-stage BJT/FET amplifier configurations, small-signal models, small signal mid-frequency equivalent circuits and analysis, low frequency and high frequency equivalent circuits of BJT/FET circuits, h-parameter model, pole zero analysis, Bode plots, frequency response of amplifiers, multistage amplifiers.
2. Differential amplifiers
   The BJT differential pair, small-signal operation of the BJT differential amplifier, characteristics of a differential amplifier, differential amplifier with active load.
3. Operational amplifiers
   Ideal opamp, negative feedback in opamp circuits, operational amplifier specifications, opamp applications, practical behavior of opamps, instrumentation amplifiers.
4. Power amplifiers
   Definitions, applications and types of power amplifiers, power transistors, transistor power dissipation, amplifier classes and their efficiency, push-pull amplifiers, harmonic distortion and feedback, heat generation of power transistors and heat sinks.
5. Power electronic devices and circuits
   Properties and applications of thyristors, triacs, diacs, uni-junction transistors, power MOSFETs, IGBTs and thermionic valve, power electronic circuits such as power controllers, Cdi.

Module Code	**EN2022**	Module Title	**Digital Electronics**			
Credits	**2.5**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/2**		

Module Objectives

1. To learn about Logic circuits, Logic families, programmable device and conversion circuits and their characterises, principle of operation, performance, and their use in digital circuits and engineering applications.

Learning Outcomes

At the end of the module the student will be able to

1. Design combinational and sequential digital circuits.
2. Differentiate characteristics of logic families.
3. Compare usage of different logic families.
4. Use programmable devices in digital circuits.
5. Compare different types of analog-to-digital and digital-to-analog converters.

Outline Syllabus

1. Combinational and sequential logic circuits
   Five variable Karnaugh maps, Quine–McCluskey method, flip-flops, latches, counters, registers and other MSI devices, design of finite state machines.
2. Logic families
   Ideal logic gates, logic levels and noise margins, dynamic response of logic gates, Analysis of logic families (fan-in, fan-out), diode logic, logic families (DTL, TTL, ECL, CMOS).

3. Programmable devices
   Programmable logic devices, PLAs, PALs, GALs, RAM and ROM chips, microcontrollers.
4. Conversion circuits
   ADC, DAC, types dual slope, successive approximation etc., common chips available.

Module Code	**ME2012**	Module Title	**Mechanics of Materials I**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/2**		

Module Objectives

1. This course aims to help engineering students to grasp the basics about structural members and their strength, stiffness and stability.

Learning Outcomes

After completing this module, the students should be able to

1. explain the basic concepts and laws of Mechanics of Materials and their application in the analysis and design of actual engineering structures and machine components
2. analyse certain problems of particular Mechanical Engineering interest with emphasis on their importance to safe design
3. recognize the relevance of these concepts in understanding the subject ME 2142 Machine Elements & Innovative Design.

Outline Syllabus

1. Introduction
   Types of engineering components, Different forms of loading and support conditions, Types of joints.
2. Concept of stress
   Static equilibrium , Internal forces, Direct stress, Shear stress, Uni-axial stress systems
3. Introduction to Elasticity : Stress and strain
   Direct and shear strains, Deformations, Displacements, Boundary conditions, elastic properties of materials, Hooke's Law, Poisson's Ratio, Thermal strain and deformation, Saint-Venant's Principle, Statically indeterminate problems. Elastic strain energy, Thin-walled spherical and cylindrical pressure vessels.
4. Bending of Beams
   Shear forces & bending moments in beams, Theory of simple bending, Bending stress distribution, Combined loading.
5. Torsion of circular bars
   Torsional shear stress distribution in circular bars, Angle of twist, Torsional strain energy applications: shaft coupling, propeller shafts.
6. 2D Stress transformation
   Transformation of stresses in 2D problems, Principal stresses, Mohr's circle of stress, combined loading.
7. Deflection of beams
   Moment-curvature relation, Governing differential equation, Direct integration solutions, Singularity functions.
8. Buckling Instability of Columns
   Euler critical loads for combinations of free, pinned and built-in end conditions, limiting stress conditions.

Module Code	**CE1822**	Module Title	**Aspects of Civil Engineering**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	–		

Module Objectives

1. To provide some basic knowledge of civil engineering in the aspects of house construction, building materials, building services and land surveying.

Learning Outcomes

1. Ability to understand the construction of a two storied house and supervise the quality and the cost effectiveness.
2. Ability to understand common building defects and their rectification methods.
3. Ability to understand the basic principles of land surveying

Outline Syllabus

1. Introduction to common civil engineering structures.
2. Identification of building materials with respect to the quality, application and their cost.
3. Identification building elements and their construction procedure for a two storied house.
4. Introduction to building services including water, sanitary facilities, electricity, fire fighting, vertical circulation.
5. Introduction to common defects in buildings and their rectification methods
6. Introduction to ICTAD specifications
7. Introduction to surveying methods and surveying applications.
8. Setting out and vertical control for buildings.

   Assignments.

   Reports based on field visits.

Module Code	**EE2183**	Module Title	**Laboratory Practice II**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. appreciate and apply electrical safety procedures.
2. demonstrate knowledge of electrical machines as applied in the industry.
3. demonstrate knowledge of power systems as applied in the industry.

Outline Syllabus

This module consists of Semester 3 Electrical Engineering Laboratory experiments in the areas of,

1. Electrical Measurements and Instrumentation
2. Electromagnetic Field Theory

One experiment may cover more than one area and would be conducted as part of a system.

Module Code	**EE1953**	Module Title	**Engineering Design**			
Credits	**1.5**	Hours/Week	Lectures	**2.0**	Pre-requisites	**Semester 1**
GPA/NGPA	**NGPA**		Lab/Assignments	**3/1**		

Module Objectives

1. To be able to understand design principles and various aspects of design and to carry out a design project.

Learning Outcomes

After completing this course, the students should be able to

1. demonstrate the ability to understand Design Principles.
2. demonstrate the ability to understand various aspects of design in several selected design case studies.
3. carrying out a group based product design assignment addressing issues such as manufacturability, marketability, creativity, team work, meeting deadlines.

Outline Syllabus

1. Design principles
   - Introduction to Engineering Design
   - Life Cycle of Engineering Products and Processes
   - Design process and Design Tools
   - Concurrent Engineering
   - Creativity and Reasoning
   - Analysis, synthesis, simulation, evaluation and decision making
2. Case studies
   Several simple but comprehensive design case studies selected from different disciplines of engineering addressing following topics:
   - Design for manufacturing
   - Mechanical and material aspect in design
   - Electrical, Electronic and IT aspects in Design
3. Group based design assignments
   The projects include (a) gathering of data and information from various sources as a preliminary to the design, (b) preparing a work plan and delegating duties, (c) working with others and to produce results by given deadlines and within given costs, (d) learning the basic procedures required for conceptual, preliminary and detailed designs, (e) learning the importance of the cost component in the manufacturing process, (f) preparing a report and making a presentation on the work done, (g) demonstrating the working of the prototype.

Module Code	**MN1030**	Module Title	**Entrepreneurship Skill Development**			
Credits	**1.0**	Hours/Week	Lectures	**0.5**	Pre-requisites	
GPA/NGPA	**NGPA**		Lab/Assignment	**3/2**		

Learning Objectives

1. To provide engaging, academically challenging and experimental learning sessions in economics and entrepreneurship education addressing the key concepts of: company structure, roles within a company, company capitalization, customer-product focus, product market pricing, company operations, product sales and company liquidation.

Learning Outcomes

At the end of this course students will be able to

1. Apply their business and entrepreneurial knowledge and skills to education, career and service pursuits
2. Recognize the significance of personal responsibility and financial literacy in making positive life decisions.

Outline Syllabus

1. Discuss leadership position, business idea, company name, vision and mission, establish company values, company capitalization process.
2. Working as a company, students conduct officer elections and learn about each department's specific responsibilities during the operation and liquidation phases.
3. Students use tools such as market surveys and cost-benefit analysis to determine potential products for their target market and develop initial business plan.
4. Students host Board of Directors meeting to approve the company's Business Plan, review implementation strategies and accept the company Charter, sell shares.
5. Materials needed for production are ordered and the company business plan is implemented.
6. Learn about specific sales techniques during selling of their product/service.
7. Students hold department meetings to share best practices and propose changes to current company operations.
8. Begin to finalize production, access excess inventory, and prepare for the Board of Directors liquidation meeting.
9. Students explore steps and learn how to apply what they have learned as a company to personal entrepreneurial pursuits.
10. Final Board of Directors liquidation meeting and approve the Annual Report.

Semester 4

Module Code	**MA2033**	Module Title	**Linear Algebra**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA1013**
GPA/NGPA	**GPA**		Lab/Tutorials	–		

Module Objectives
1. To understand the principles of Linear Algebra.
2. To apply methods of Linear Algebra to solve engineering problems.

Learning Outcomes
At the end of this module the student should be able to
1. reduce a matrix using gauss-jordan reduction.
2. solve a system of n equations in m variables.
3. find the inverse of a matrix, eigen values and eigenvectors of a matrix
4. understand the dimension of a vector space, rank of a matrix and basis for a vector space.
5. understand the concepts of linear independence, linear transformation and determinants.
6. apply theories learnt above to solve engineering problems.

Outline Syllabus

Vectors spaces, subspaces, linear combinations, spanning sets, linear independence and bases, column space, row space and the rank of a matrix ; Linear transformations; Eigen values and eigen vectors of nxn matrices; Inner product spaces, diagonalization of matrices, quadratic forms, Cayley-Hamilton theorem, the matrix form of a linear transformation

Module Code	**MA2053**	Module Title	**Graph Theory**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA1013**
GPA/NGPA	**GPA**		Lab/Tutorials	–		

Module Objectives
1. To understand the concepts of graph theory.
2. To understand the application aspects of graph theory.

Learning Outcomes
At the end of this module the student should be able to
1. apply graph theory to devise various search algorithms and other algorithms applied in scientific computing.
2. apply graph theory in other areas such as Operational Research.

Outline Syllabus
1. Basic definitions, degree of a vertex, paths, cycles and connectivity.
2. Digraphs, relationship graphs, Eulerian and Hamiltonian graphs.
3. Shortest path problems: Dijkstra's algorithm.
4. Isomorphism of graphs, adjacency, matrices and adjacency lists.
5. Planar graphs, coloring of graphs.
6. Trees: Properties, spanning trees, rooted trees, binary trees, binary search and applications.

Module Code	**EE2013**	Module Title	**Circuit Theory**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2183**
GPA/NGPA	**GPA**		Lab/Assignment	**–**		

Module Objectives

1. To be able to apply principles of electricity and mathematics to analyse and synthesize electric circuits.

Learning Outcomes

After completing this module the student should be able to

1. derive network functions for a given circuit and thereby understand the circuit properties.
2. simulate a circuit using computer software.
3. synthesis networks and filter circuits.

Outline Syllabus

1. The s-plane
   The general complex exponential excitation function; Network functions; Pole-zero patterns; properties of LC, RC and RLC network functions; energy functions.
2. Introduction to the state-space representation
   The selection of state variables, transformations, canonical forms.
3. Computer aided circuit simulation
   DC and AC circuit simulation using SPICE, circuit description using netlist, text based simulation, graphical simulation tools.
4. Synthesis of passive networks
   Synthesis of LC, RC, & RLC networks; Cauer, Foster canonical forms and other methods.
5. Classical filter design
   Impedance matching, low pass, high pass and band pass filters; basic sections; Modern filter design: Butterworth and Tschebycheff approximations etc., frequency transformations; Active filter design.

Module Code	**EE2023**	Module Title	**Electrical Machines and Drives I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2183**
GPA/NGPA	**GPA**		Lab/Assignment	**–**		

Module Objectives

1. To acquire the knowledge of fundamental principles of electrical machines and their operation.
2. To understand theory and practice of electromechanical energy conversion.
3. To understand the design principles and operation of single phase transformers.
4. To understand the design principles and operation of direct current motors and generators.

Learning Outcomes:

After completing this module the student should be able to

1. select the most suitable types of materials for a given machine design.
2. demonstrate the knowledge of electromechanical energy conversion principles.

3. identify applications that need DC motors, DC generators, or single phase transformers and apply them.
4. do basic design of a single phase transformer.
5. solve operational problems in DC motors and single phase transformers.
6. perform calculations of DC motors, DC generators and single-phase transformers.

Outline Syllabus

1. Materials in electrical machines
   Properties of different grades of iron, permanent magnets, special alloys, conductors, insulation materials and superconductors, Atomic magnetism, magnetization curve, magnetic losses, ferro-fluids, Design with permanent magnets.
2. Electromechanical energy conversion
   Energy balance equation, Principles and production of force/torque in linear and rotary coupled circuits, Stationary and rotating magnetic fields, Overall relationship between machine dimensions and power, specific electric and magnetic loading.
3. DC machines
   Construction and operating principle, separate, shunt, series and compound excited motors, steady state equivalent circuit and characteristic, dynamic behaviour, speed control, starting, braking, applications.
4. Single-phase transformers
   Construction, equivalent circuit, testing, characteristic, parallel operation, autotransformers, pulse transformers, high frequency equivalent circuit.

Module Code	**EE2033**	Module Title	**Power Systems I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. The aim of this course is to give basic introduction to power system including generation, distribution and transmission.

Learning Outcomes

After completing this module the student should be able to

1. compare the role, functions and the structure of Sri Lanka's power system with those of other developed/developing countries and to analyze its performance in the light of global trends.
2. demonstrate knowledge of energy conversion technologies to generate electricity and assess their advantages, disadvantages and effects on environment.
3. demonstrate knowledge of the characteristics and construction of underground and overhead transmission systems, their effects on environment and human life.
4. design a simple distribution system taking into consideration the basic concepts in distribution system design.

Outline Syllabus

1. Introduction to power systems (2 hrs)
   Present scenario in energy, global and local trends. Development, structure and management of the electric power system in Sri Lanka.
2. Power generation technologies (8 hrs)
   Fossil fuel-based generating systems (coal steam, oil steam, diesel, gas turbine, combined cycle, combined heat and power). Nuclear Energy Systems, nuclear fuel cycle,

types of reactors. Hydro electric systems - storage, run-of-river, micro/mini, pumped storage. New and renewable energy systems - wind, solar thermal, solar photovoltaic, wave, tidal, OTEC, geothermal. Environmental and ecological considerations, safety issues..

3. Power transmission systems (10 hrs)
   Overhead and underground systems, conductor and cable types, insulating materials, line construction and accessories. Environmental, safety and health issues. Insulators: Types, electrical and mechanical specifications. Insulator string voltage distribution. Transmission line models and performance calculations
4. Power distribution (8 hrs)
   Overhead and underground systems, feeders and distributors, ring and radial systems, , principles of electricity tariff, tariffs in Sri Lanka, end use equipment, introduction to demand management and conservation of electricity.

Module Code	**EE2193**	Module Title	**Laboratory Practice III**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignemnt	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. appreciate and apply electrical safety procedures.
2. demonstrate knowledge of control systems as applied in the industry.
3. demonstrate knowledge of electrical installations as applied in the industry.
4. demonstrate knowledge of electrical machines as applied in the industry.
5. demonstrate knowledge of power systems as applied in the industry.

Outline Syllabus

This module consists of Semester 4 Electrical Engineering Laboratory experiments in the areas of,

6. Electrical machines and Drives I
7. Power systems I

Experiments may cover more than one area and would be conducted as part of a system.

Module Code	**ME2842**	Module Title	**Basic Thermal Sciences and Applications**			
Credits	**3.0**	Hours/Week	Lectures	**2.5**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**3/2**		

Module Objectives

1. To provide knowledge of basic thermodynamic principles and to understand the behaviour of basic thermodynamic processes and systems.

Learning Outcomes

After completing this module, the students should be able to

1. explain the basic thermodynamic principles.
2. use Thermodynamic Property Tables.

3. use the relevant properties to calculate non-property quantities in Thermodynamic systems.
4. apply the laws of thermodynamics to basic processes.
5. apply basic knowledge of heat transfer to analyse simple engineering problems.
6. use the psychrometric property chart to do basic calculations.
7. carry out basic estimations related to power cycles.

Outline Syllabus

1. Basic Principles
   Review of Boyle's law, Charles's law etc. Forms of energy and their transformations, Heat and Work as methods of Energy transfer, the statistical nature of thermodynamics, types of systems.
2. Properties of Substances
   Importance of Thermodynamic properties, Intensive and Extensive properties, Concept of Thermodynamic state, Thermodynamic Equilibrium. Difference between ideal and real substances, Thermodynamic Property tables.
3. Fundamental laws of thermodynamics
   First Law of Thermodynamics, First law with reference to principal system types, Internal energy as a consequence of the First law. Reversible process, Second law of thermodynamics, Entropy as a consequence of the Second law.
4. Processes
   Basic types of processes, Processes as transition of Thermodynamic states, Property Diagrams, Reversible and Irreversible processes, Cyclic Processes.
5. Heat Transfer
   Mechanisms of heat transfer, Heat transfer applications in Engineering.
6. Psychrometrics
   Thermodynamic properties in Psychrometrics, Estimations using psychrometric charts.
7. Power Cycles
   Idealised gas & vapour power cycles and performance indices, Basic estimations.

Module Code	**EE3203**	Module Title	**Individual Project**			
Credits	**2.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**-**		

Module Objectives

1. The aim of this course is to develop the generic skills through the learning experience of working on an individual project.

Learning Outcomes

After completing this module the student should be able to

1. plan and design an engineering project independently, adopting a system approach.
2. identify sources of data, components and standards.
3. apply standard software for engineering solutions.

Outline Syllabus

1. Design of an engineering product or system individually and independently.
2. Complying with financial, environmental and social requirements.
3. Presentation of results.

Module Code	**EE3953**	Module Title	**Communication and Presentation Skills**			
Credits	**1.5**	Hours/Week	Lectures	**1.5**	Pre-requisites	**None**
GPA/NGPA	**NGPA**		Lab/Assignment	–		

Module Objectives

1. The Engineer in Society today needs to be able to communicate effectively verbally and in writing and translate ideas and plans as a team member in addition to being proficient in technical abilities in the field of Electrical Engineering.

Learning Outcomes

After completing this module the student should be able to

1. read critically and analyse the content to locate the important points.
2. develop reports that present ideas clearly and systematically.
3. compose technical papers in standard formats.
4. present a given topic clearly through oral presentations with and without multimedia support.
5. decide on the appropriate content and the length of the presentation.
6. engage the audience with the presentation.
7. review speeches and presentations in front of an audience.

Outline Syllabus

1. Critical reading of technical literature and summarizing contents.
2. Report writing, Technical non-technical.
3. Design and development of presentations.
4. Question and Answer sessions based on the presentation.
5. Evaluation of presentations.
6. Debates and discussions.

Module Code	**MN2010**	Module Title	**Entrepreneurial Leadership**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/2**		

Learning Objectives

1. This course is focused on developing the skills that lead to change students' mindset to act as a successful leader which is an essential requirement to become a successful entrepreneur/intrapreneur. These skills will be exercised in the context of entrepreneurial environment. Through participation in a series of exercises students will have the opportunity to discover and expand upon students' leadership ability.
   (This is a problem-based learning course: learning-by-doing is the modus operandi. Class lectures are minimized).

Learning Outcomes

After completing this module the student should be able to

1. create a personal inventory of strengths and weaknesses
2. create a vision for what a student wants to achieve
3. develop a mindset to embrace and understand failure rather than fear it
4. develop skills in terms of problem solving and decision making
5. build and lead a team in a competitive environment
6. make professional presentations
7. understand how and why individuals become successful in the business world.

Outline Syllabus

1. Introduction to entrepreneurial leadership
2. Leadership skills, abilities and qualities
3. Leader as a team builder
4. Leader as a motivator
5. Leader as an effective communicator and negotiator
6. How leaders play a critical role in shaping an organization's culture
7. Ethical behavior of a leader
8. Entrepreneur Presentation (by Entrepreneurs with good leadership skills)
9. Case Studies and Presentations

Semester 5

Module Code	**MA3013**	Module Title	**Applied Statistics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA2073**
GPA/NGPA	**GPA**		Lab/Tutorials	–		

Module Objectives

1. To understand discrete and continuous random variables
2. To understand statistical Inference
3. To implement applications using statistical software.

Learning Outcomes

At the end of this module the student should be able to,

1. identify the role of probability and statistics in their discipline area.
2. perform a range of statistical procedures related to the manipulation and interpretation of data.
3. distinguish between types of statistical tests that may me used to analyze data.
4. demonstrate basic knowledge of assessing the appropriateness of statistical models.
5. demonstrate practical expertise associated with the use of statistical package in performing basic statistical procedure.

Outline Syllabus

1. Discrete and continuous random variables
   Bivariate distributions. Moment generating function. Introduction to ML estimators. Basic properties of Geometric, Hyper geometric, Exponential and Gamma, distributions. Student's t-distribution. Fisher's distribution and Chi square distribution.
2. Statistical Inference
   Sampling distributions, central limit theorem, confidence intervals for mean and variance. Hypothesis tests. Goodness-of-fit tests and contingency table. Simple linear regression. Least square estimation and hypothesis tests in simple linear regression.
3. Practical Work
   Use of MINITAB for statistical testing and regression analysis.

Module Code	**MA3023**	Module Title	**Numerical Methods**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA1023**
GPA/NGPA	**GPA**		Lab/Tutorials	–		

Module Objectives

1. To understand the necessity of using numerical methods in Engineering
2. To solve ordinary differential equations by numerical methods.
3. To solve partial differential equations using numerical methods.

Learning Outcomes

At the end of this module the student should be able to

1. solve a system of linear equations by various numerical methods.
2. solve a system of non-linear equations by various numerical methods.
3. find maxima and minima of functions of several variables by numerical methods.
4. solve an initial value problem involving an ordinary differential equation by various numerical methods.
5. solve an initial-boundary-value problem involving a partial differential equation by various numerical methods

Outline Syllabus

1. Gaussian elimination, Jacobi's and Gauss-Siedel methods.
2. Curve fitting.
3. Numerical solution of a system of non-linear equations; numerical optimization;
4. Numerical solution of an ordinary differential equation: Taylor series method, Euler's method and Runge-Kutta methods;
5. Numerical solution of partial differential equation: Initial boundary value problems involving Heat equation, Wave equation and Laplace's equation.

Module Code	**MN3042**	Module Title	**Business Economics and Financial Accounting**			
Credits	**3.0**	Hours/Week	Lectures	**3.0**	Prerequisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	–		

Module Objectives

The objective of this module is to impart to the students:

1. The ability to understand principles of business economics.
2. The ability to be familiar with accounting techniques used in business.
3. The ability to evaluate business projects using appropriate financial techniques.

Learning Outcomes

1. To define the basic micro and macro economic concepts. Identify of the links between economy and technology.
2. To define basic concepts in financial, cost and management accounting.
3. To apply basic knowledge on these accounting concepts to business environment and to interpret main accounting statements.

Outline Syllabus

1. Business Economics
   Economics and the economy; Elementary theory of Economics; Tools of economic analysis; Demand, supply and the market; Theory of the firm; Different types of firms; Motivation of firms; Theory of supply; Costs and production; Introduction to macroeconomics and national income accounting.
2. Financial and cost Accounting
   Basic accounting concepts; Trial balance; Profit & loss account, balance sheet; Cash flow statements; Interpretation of accounts; Cost concepts and terminology; Analysis and interpretation of cost; Allocation of overheads; Marginal costing, CPV analysis; Standard costing; Stock control.

Module Code	**MN 3052**	Module Title	**Industrial Management and Marketing**			
Credits	**3.0**	Hours/Week	Lectures	**3.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	–		

Module Objectives

The objective of this module is to impart to the students:

1. The ability to understand principles Industrial management
2. The ability to be familiar with marketing tools and practices
3. The ability to evaluate business projects using appropriate financial techniques.

Learning Outcomes

1. To describe basic concepts and theories of organizational management. To explain the

application of these theories for modern organizations.
2. To describe the fundamentals of technology management, human resource management and legal issues related to modern industrial relations.
3. To explain basic marketing concepts and theories and their applications.

Outline Syllabus

1. Organization management
   Introduction to management & systems theory; Organizational theory; stakeholder analysis, organizational vision, mission & objectives. Types of organizations; organizational strategy, structures of modern organization and the concept of learning organization; Different roles of manager; manager & leader. Organizational culture & control; concepts of authority, power, responsibility & their applications and management of conflict. Management of change; importance of change management and conflict management. Modern management techniques; management styles: Japanese vs. Western Systems.
2. Technology management
   Technology and economic development; Key concepts of technology management and its relation to business management; Technology and competitive advantage; Evaluating technology;
3. Human Resource Management and Industrial Relations (6 hrs)
   Introduction to human resource management, Employee selection, performance evaluation, rewards, Human resource development, Compensation and grievance handling, Labour - Management Relations in Sri Lanka and Business Ethics.
4. Marketing
   Marketing: overview; Marketing environment, marketing research and product life cycles; Buyer behavior: consumer and organizational; 4Ps of marketing including promotion and communication issues.

Module Code	**EE2053**	Module Title	**Control Systems I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2193**
GPA/NGPA	**GPA**		Lab/Assignment	**1.0**		

Module Objectives

1. To understand the mathematical modelling and fundamental concepts of feedback control of dynamical systems.
2. To understand the basics of stability analysis of dynamical systems.
3. To analyse dynamical systems in time-domain and frequency domain.
4. To analyse control systems using CAD tools.

Learning Outcomes

At the end of this module the student should be able to

1. derive mathematical models of a variety of electrical, mechanical, and electro-mechanical systems.
2. compare the open loop and closed loop (feedback) systems
3. understand the concept of stability of a dynamic system
4. draw the pole-zero diagram and the root loci, which are the change in location of the poles as parameters are of a system are varied.
5. use frequency response and frequency domain techniques to design controllers.
6. estimate time response of systems to impulse, step, ramp, and sinusoidal inputs from the transfer function.

7. identify the importance of three term (PID) controllers
8. use Matlab® with facility to aid in the analysis and design of control systems.
9. construct simple feedback circuits using op-amps.

Outline Syllabus

1. Introduction to control systems
   Historical Background and examples of control system applications, Open-loop Versus Closed-loop Control, On-off and hysteresis band control ,Basic Components of a Control System, Analog Control Versus Digital Control, Analog versus digital implementation, DSPs in control systems, Continuous Control Versus Discrete Control and PLCs.
2. Modelling of systems
   Differential equation of physical systems, Linear versus nonlinear systems, Laplace transforms, transfer functions and block diagrams, block diagram simplification, state variable models.
3. Feedback control systems
   Open and closed loop control systems, transient response, disturbances steady state errors, cost of feedback, test input signals, performance of a second order systems, time response, stability, steady state error.
4. Root Locus Techniques
   Definition, Properties, and Sketching Rules. Design via Root Locus. Three term (PID) controllers.
5. Frequency Response Techniques
   Frequency response plots, sketching rules, Bode Plots, Design via Frequency Response.
6. Stability in the frequency domain
   Mapping contours in the S plane, Nyquist criterion, system bandwidth, stability with time delays, PID controller in frequency domain, stability in frequency domain using MATLAB.

Module Code	**EE3073**	Module Title	**Electrical Installation I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. Know the non-statutory and statutory regulations relating to the provision of an electrical installation.
2. Understand the methods used to protect electrical installation and to be able to design an Electrical Installation.
3. Be able to interpret wiring diagrams used in electrical installation

Learning Outcomes

After completing this module the student should be able to

1. demonstrate the understanding of the structure of the IEE Wiring Regulations and apply it for electrical installation designs.
2. distinguish the characteristics of different types of protective devices used in Electrical Installations, their principle of operation, advantages and disadvantages.
3. assess the general characteristics of an electrical installation and differentiate among electrical wiring systems in Domestic, Commercial and Industrial applications.
4. select correct type and size of cables in electrical installations.

5. select the earthing system for a particular electrical installation at medium voltages.
6. design electrical layouts and wiring diagrams for electrical installations according to the given environmental conditions.
7. draw up complete wiring circuit using CAD package.
8. use technical documents in electrical installations and prepare technical documents involved in electrical installations.
9. carry out inspection and testing in electrical installations

Outline Syllabus

1. Introduction to Wiring Regulations
   Structure of the 17th Edition of the IEE Wiring Regulations (BS 7671: 2008), its importance and applicability to Sri Lanka.
2. Types of electrical earthing systems
   TT, TN, IT systems and their features, commonly used grounding arrangements.
3. Electrical safety and protective measures
   Protection against electric shock, protective equipment and conductors. Protection systems adopted in wiring systems. Electrical Safety measures.
4. Design criteria of electrical installations
   Assessment of general characteristics of an electrical installation, Demand calculation and diversity. Sizing and selection of cables, accessories, current rating of cables, voltage drop, temperature dependence, steps in the design of a small electrical installation.
5. Wiring design using CAD
   Use of a software package for electrical wiring design.
6. Technical documents
   Preparation and use of: Tender documents, technical specifications and drawings, bill of quantities, contract documents.
7. Inspection, testing and certification
   Earth resistivity measurements, ground resistance calculations, continuity and insulation testing, polarity checking. Basic Testing and commissioning of electrical installations, preparation of test reports.

Module Code	**EE2073**	Module Title	**Electrical Machines and Drives II**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE2193**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To learn about the construction, operation, control, testing, analysis and application of three-phase/single-phase induction motors of different types.
2. To learn about the power electronic drive systems, the controlling of three-phase/single-phase induction motors.
3. To learn about the three-phase power transformers, their windings balanced & unbalanced load operation, protection and general performance calculations.

Learning Outcomes

After completing this module the students should be able to

1. compare performance of different types of three-phase transformers and induction motors and select the most suitable type for a given application.
2. choose the most suitable starting, braking, or speed control equipment for a three-phase induction motor for a given application.

3. compare performance of different types of single phase AC motors and select the most suitable motor.
4. perform calculations of steady state behaviour three-phase transformers, three-phase induction motors and single-phase motors.

Outline Syllabus

1. Three-phase transformers
   Construction of different types, vector group, per-unit equivalent circuit, characteristic, losses and efficiency, magnetization phenomena, unbalanced loading, parallel operation, tap changing, inrush current
2. Three-phase induction motors
   Squirrel cage rotor and wound rotor types, equivalent circuits, torque-speed characteristics, losses and efficiency, NEMA classes, testing, starting, braking, principles of speed control, operation as a generator, motor applications.
3. Single-phase motors
   Induction motors of different types, equivalent circuit calculations, torque-speed characteristic, methods of speed control, applications, AC commutator motor (universal motor).

Module Code	**EE2083**	Module Title	**Power System II**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	**Co-requisites**	**EE2193**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

The objective of this module is to impart to the students:

1. The ability to be familiar with transmission line parameter.
2. The ability to understand the power flow criteria in a transmission system.
3. The ability to understand the nature of the fault currents in a power system.

Learning Outcomes

After completing this module the student should be able to

1. perform calculation of transmission line parameters and evaluate the performance characteristics of the transmission system.
2. design an overhead line for a power system to comply with standards.
3. perform load flow analysis on power systems using different techniques.
4. calculate the short circuit currents for balanced and unbalanced faults in a power system.

Outline Syllabus

1. Transmission line parameters
   Calculation of transmission line parameters; resistance, inductance, capacitance for solid, stranded and bundled conductors. Transposition, long line performance calculations, Ferranti effects, shunt and series compensation. line power limits.
2. Mechanical characteristics of overhead lines
   Types of towers, conductor spacing and configuration, choice of route, line profile, Sag and span calculations, sag templates, stringing charts.
3. Load flow analysis
   Mathematical techniques of load flow analysis, active and reactive power flow calculations, tightly/loosely coupled networks, contingency analysis.
4. Fault analysis
   Causes and effects of faults. Review of per unit system and symmetrical components.

Symmetrical three-phase faults. Asymmetrical faults, short circuit and open circuit conditions. Introduction to simultaneous faults

Module Code	**EE3183**	Module Title	**Laboratory Practice IV**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. appreciate and apply electrical safety procedures.
2. demonstrate knowledge of control systems as applied in the industry.
3. demonstrate knowledge of power electronic drives as applied in the industry.
4. demonstrate knowledge of electrical machines as applied in the industry.
5. demonstrate knowledge of power systems as applied in the industry.

Outline Syllabus

This module consists of Semester 5 Electrical Engineering Laboratory experiments in the areas of,

1. Control Systems I
2. Electrical Installations I
3. Electrical Machines & Drives II
4. Power Systems II

Experiments may cover more than one area and would be conducted as part of a system.

Module Code	**MN3010**	Module Title	**Multidisciplinary Design, Innovation and Venture Creation**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/2**		

Learning Objectives:

1. To develop competencies in multidisciplinary design and creative problem solving to produce innovative products, processes and systems meeting societal, environmental and economic trends.
2. To introduce state of the art technologies and their integration with conventional technologies for rapid transformation of ideas to new products, processes and systems.
3. To introduce several leading technological entrepreneurs and the ventures they created based on design led innovations.
4. To provide knowledge in user needs assessment and for commercialization of new technologies.
5. To carry out a client based multidisciplinary design project.

Learning Outcomes

After completing this module the student should be able to

1. analyse a user need critically considering societal, environmental and economic aspects

2. design and develop innovative products, processes and complex systems with a multidisciplinary perspective
3. use state of the art digital technologies together with conventional technologies for rapid product, process and systems design and development
4. develop a product, process, system to meet a client based multidisciplinary design.

Outline Syllabus

1. Introduction to Creativity and Innovation
2. Role of Design under societal, environmental and economic trends
3. User Needs Assessment for user centered design
4. Multidisciplinary Design and creative problem solving
5. Product Analysis and Innovative Product Development
6. Analysis of Processes and Innovative Process Development
7. Complex Systems and Complex System Development
8. Conventional Technologies for transformation of ideas to new products
9. State of the Art technologies for rapid transformation of ideas to new products
10. Social Entrepreneurship and innovations
11. Sustainability, Green technologies, Cleaner production and Green products
12. Technological ventures based on design led innovation (Global, Local)
13. Commercialization strategies for new technologies

Industrial Training

<table>
<tr><td>Module Code</td><td>EE3993</td><td>Title</td><td colspan="4">Industrial Training</td></tr>
<tr><td>Credits</td><td>6.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>-</td><td>Pre-requisites</td><td>None</td></tr>
<tr><td>GPA/NGPA</td><td>NGPA</td><td>Training</td><td colspan="3">20 weeks full time</td></tr>
<tr><td colspan="7">Module Objectives
1. First hand direct exposure as a training opportunity for the student to experience working in an Industry environment in both Government and private sector as potential employers</td></tr>
<tr><td colspan="7">Learning Outcomes
After completing this module the student should be able to
1. identify how the theoretical principles learnt as an undergraduate could be applied practically.
2. demonstrate the skills, knowledge and attitudes needed for an effective start of the engineering profession.
3. work with different categories of people in an industrial environment.
4. adopt appropriate technical, environmental, economic and social constraints.
5. demonstrate knowledge of organizational, financial and human resource management.</td></tr>
<tr><td colspan="7">Outline Syllabus
1. Induction from academic to industrial life.
2. Practical skills in planning, design, Installation, commissioning and maintenance.
3. Interaction with superiors and subordinates .
4. Teamwork and responsibility.
5. Safety practices.
6. Systems approach.
7. Management.</td></tr>
</table>

Semester 6

Module Code	**EE3063**	Module Title	**Energy Systems**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

The objective of this module is to impart to the students:

1. The ability to understand the present and future energy needs of the people.
2. The ability to understand the important role played by the energy sector in the macro economy.
3. The ability to understand the problems regarding the energy production and usage.

Learning Outcomes

After the completion of the course the student should be able to

1. identify the primary energy sources, their limitations and costs.
2. assess the world/Sri Lanka energy demand and the demand growth.
3. understand the different energy conversion processes, their efficiencies and associated economics.
4. appreciate the necessity of energy policies in the international level as well as at the individual country level.
5. understand the Sri Lanka energy policy.
6. evaluate the relationship between economic development and energy. Energy as a catalyst to all sectors of a macro economy.
7. appreciate the importance of energy planning, energy management, energy economics and pricing.

Outline Syllabus

1. Introduction
   Conventional Energy Resources: Major hydro, Coal, Oil, Natural gas, Uranium; Major reserves, Depletion rates.
   Non Conventional Energy Resources: Small hydro, Solar, Wind, Biomass, Tidal, Geothermal; Their limitations, Barriers for commercial deployment
2. Energy Consumption / Demand
   Energy consumption in developed and developing countries, regional consumption patterns, sectoral consumption, per capita consumption. Global/Sri Lanka Demand for energy, Demand growth patterns and forcasts, Energy and the economy.
3. Energy Conversion Processes
   Primary conversion processes, Oil refining, Gasification of coal and bio fuels, Energy Conversion processes at end use, their efficiencies, costs of conversion.
4. Energy Policy
   Energy policy by world energy council, Energy policy in Sri Lanka.
5. Energy Planning / Energy Management
   Energy data bases, Development of an energy balance, Integrated energy planning, Supply side and Demand side energy management.
6. Energy Economics
   Economic comparison of energy supply systems, Energy Pricing, Financial and economic cost-benefit analysis of energy sector projects.
7. Environmental Concerns
   Environmental impacts of energy projects and related costs. Regulatory requirements, International protocols, Carbon Trading.

Module Code	**EE4013**	Module Title	**Automation and Control Technologies**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE4183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. Introduce the hardware used in automation and selection of appropriate hardware for the specific project
2. Practical application of the theories leant under the "control systems" for a real word automation task.
3. Develop the analytical and design skills to carry out a real word PLC based automation task.
4. Develop the skills of assessing an automation task economically and socially.

Learning Outcomes

After completing this module the student should be able to

1. decide whether a certain process should be automated or not based on Technical, Economical and Social facts.
2. Identify the steps involved in practical automation.
3. apply the knowledge gained in a real automation exercise.
4. assess future trends and needs of automation.

Outline Syllabus

1. Introduction
   Devices used in Automation, Coils, Contacts, Timers and Counters, Logical Program Development, Other Sensors and Actuators, Safety in Industrial Automation, Economics of automation.
2. Actuator Systems
   Components, Proportional and Servo Valves; Pneumatic Control Systems: System Components, Controllers.
3. Architecture of Industrial Automation Systems
   Process Control: P-I-D Control, Controller Tuning, Special Control Structures: Feed forward and Ratio Control, Predictive Control, Control of Systems with Inverse Response, Cascade Control.
4. Sequence and digital Control
   PLCs and Relay Ladder Logic, Scan Cycle, RLL Syntax, Structured Design Approach, Hardware environment; DSPs.
5. Integration of Sensors, Actuators and Controllers.
6. Introduction to Production Control Systems.
7. Social Aspects and future trends in Automation.

Module Code	**EE4033**	Module Title	**Electrical Installation II**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE4183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. Understand the of artificial lighting design and air conditioning system design techniques for buildings,
2. Understand the structural lighting protection principles and related national and international standards

3. Knowledge on selection criteria of switchgears for substation and design of substation grounding system

Learning Outcomes
After completing this module the student should be able to
1. carry out a lighting design for a building environment.
2. practice safety regulations & standards and behave in a safe manner in the electrical working environment.
3. apply lightning protection principles for an electrical installation.
4. use air conditioning, ventilation, Emergency lighting, fire detection and alarm systems.
5. manage resources of building environments.
6. distinguish different requirements of special installations.

Outline Syllabus
1. Engineering Acoustics
   Sound power, measurement, sound level estimation, sound pollution, noise control.
2. Artificial lighting and lighting design
   Physics of illumination, vision and perception of colour, lamps and luminaries, lighting design by manual methods, lighting design software, lighting control and automation.
3. Air conditioning, ventilation, fire detection and alarm systems
   HVAC and fire safety, air conditioning, load calculations and design, ventilation systems, fire detection systems, alarm systems.
4. Building management systems

Module Code	**EE4073**	Module Title	**Computer Aided Design and Simulation**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**-**		

Module Objectives
1. To introduce basic and advanced capabilities of computer aided design tools of AutoCAD, MATLAB and PSpice.
2. To be able to model complex systems using IT tools.
3. To be able to simulate systems and circuits using computer aided tools.

Learning Outcomes
1. After the completion of the module the student should be able to
2. use computer aided drafting packages for design and modelling of 2D/3D objects.
3. model dynamic behaviour of a physical system and simulate it on a digital computer.
4. design and analyse electrical circuits using circuit design and simulation packages.
5. solve numerical problems using numerical analysis packages.

Outline Syllabus
1. Introduction
2. Why Computer Aided Design (CAD) and Computer Aided Simulations (CAS), Model designs, Optimum system configuration through CAD and CAS, Examples.
   Computer Aided Drafting
3. Computer aided spatial design, drawing primitives, making complex objects by combining primitives, model space, paper space, 2D/3D visualisation, real world problems.
   System Modelling
4. Classification of dynamic systems, Elements in electrical systems, mechanical systems,

chemical systems, hydraulic systems and other non-linear systems.
System Simulation

5. Computer aided simulations and available packages, Creating simulation environment for different problems, Creating data files from the simulation, data visualization.
Circuit Simulation
6. Analysis and simulation of electrical circuits using a circuit simulation package. Steady state and transient analysis.
7. Laboratory Design Examples and Laboratory Assignments.

Semester 7

Module Code	**EE3013**	Module Title	**High Voltage Engineering I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To understand the electrical breakdown phenomena occurring in insulation materials and to analyse the same.
2. To learn about the phenomena of lightning and how it affects the transmission lines.
3. To select underground high voltage cables taking into account their properties.

Learning Outcomes

At the end of the module, the student should be able to

1. demonstrate understanding of the polarization of a medium.
2. select materials for applications based on the properties of the dielectric.
3. calculate the occurrence of lightning in transmission lines based on the isokeraunic level.
4. identify the losses occurring in cables and calculate the same.
5. carry out a theoretical design of a cable based on minimising its stress distribution.
6. determine the current rating of a cable based on its thermal behaviour.

Outline Syllabus

1. Dielectric Materials
   Polarization of a medium. Free and bound charges in a capacitor. Relationship between electric field, polarization, displacement, permittivity and susceptibility. Thermal classification of dielectrics. Properties and selection of dielectric materials.
2. Breakdown of Gaseous Insulation
   Ionisation of Gases: Ionisation and breakdown processes in gases. Time lags of Spark breakdown. Corona Discharges: Mechanism of corona formation and Power Loss.
3. Breakdown of Liquid and Solid Insulation
   Breakdown in Liquids: Breakdown of Commercial liquids; Breakdown due to gaseous inclusions, liquid globules, solid particles. Purification of a liquid for testing. Breakdown of Solid Insulating Materials. Breakdown of Composite Insulation.
4. Lightning Phenomena
   Mechanism of Lightning: Frequency of occurrence of lightning flashes. Lightning Problem for Transmission Lines. Shielding by overhead ground wires. Effects of Lightning on a Transmission Line.
5. High Voltage Cables
   Power loss in the cable. Impregnated paper insulation. Insulation Resistance, Capacitance, Copper Space Factor. Dielectric stress in a single core cable: Cable Grading for Uniform Stress Distribution. Pressurised high voltage cables. Thermal design of cables:. High voltage bushings.

Module Code	**EE3023**	Module Title	**Control Systems II**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. Design and analysis of complex MIMO and non-linear dynamical systems

2. Compare and contrast different control approaches
3. Study and analysis of theoretical and implementation aspects of computer-based sampled-data control systems.

Learning Outcomes
At the end of this module the student should be able to,

1. model, simulate, and control of SISO/MIMO linear/nonlinear systems.
2. comparison of variety of control techniques with respect to a given control problem.
3. design, implement, and evaluate controllers for SISO/MIMO linear/nonlinear systems.
4. examine the use, theoretical and implementation aspects, and potential of computer-based control and modern control techniques.

Outline Syllabus

1. State-Space Methods
   Introduction, solution of the state equation, state-transition matrix, characteristic equation and the eigenvalues, stability and the eigenvalues ,controllability and observability, observer design, state feedback control ,state feedback with integral control ,canonical forms.
2. Digital Control
   Background, analog versus digital control , mathematical methods of discrete systems, the z-transform, discrete time transfer function, stability, modified Routh's criterion, design of digital control systems.
3. Nonlinear Control
   Linear vs nonlinear systems, linearized systems, Lyapunov-based methods, stability using Lyapunov method, phase-plane method, feedback linearizing control.
4. Intelligent and Adaptive Control
   Neurocontrol: Radial basis function (RBF) NNs ,multi-layer perceptron (MLP) NNs, Identification-based indirect control ,Design examples. Fuzzy Logic Control (FLC): The three-step process of generating FLCs, Fuzzy PID control, Design examples. Adaptive Control: Conventional adaptive control, Adaptive PID control, Neuroadaptive control.

Module Code	**EE3033**	Module Title	**Electrical Machines and Drives III**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To provide knowledge required to understand the performance, the behaviour and the application of synchronous generators, DC drives, Brushless DC drives and Stepper drives.

Learning Outcomes:
After completing this module the students should be able to

1. operate a large generator and vary its output power within safe limits
2. bring in a generator parallel with another
3. perform calculations of steady state behaviour of AC generators
4. design a DC motor drive system for one, two or four quadrant operation.
5. distinguish between conventional and brushless DC drive options in terms of cost and performance.
6. select the best DC drive system for a given application to meet specified performance standards.

7. compare performance of different types of stepper motors and select the most suitable type for a given positioning application.
8. identify essential operational constraints in stepper motors and design drive systems to comply with them.
9. perform calculations of DC drives, brushless DC drives, stepper drives and switch reluctance drives.

Outline Syllabus

1. Synchronous generators for bulk generation
   Cylindrical rotor and salient pole rotor types, constructional features, windings, cooling, excitation, equivalent circuit, phasor diagram, power-angle characteristic, safe operation, turbine-governor characteristic, real power control, reactive power control, AVR, parallel operation, synchronizing, earthing.
2. DC motor drives
   One, two and four quadrant drives using Power Electronic converters of different types, closed loop and open loop control, servo drives and adjustable speed drives, transient over current, implementation of dynamic and regenerative braking, soft starting, motor-converter coordination,
3. Brushless DC motor drives
   Trapezoidal and sinusoidal types of motors, construction, principle of operation, drive system, performance calculation, open and closed loop control, multi-quadrant operation.
4. Stepper motor drives
   Types of stepper motors and their constructions, stepping sequence, torque characteristic, dynamic performance, operational constraints, drive systems, unipolar and bipolar excitation, closed loop operation (switch reluctance motor).

Module Code	**EE3043**	Module Title	**Power system III**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To evaluate and predict the stability of a power system.
2. To recognize the requirement of protection of power systems and to determine the protective relaying equipment/methods require at different levels of the power system.
3. To design a protective relay scheme for a simple power system and validate its accuracy through a simulation study, which need be modeled using commercial power systems software.

Learning Outcomes

After completing this module the student should be able to

1. demonstrate knowledge of power system stability, factors that influence system stability and methods to improve and maintain stability.
2. demonstrate knowledge of the general requirements of protective relaying.
3. select suitable instrument transformers for metering and protection, optimization of their protection functions.
4. demonstrate knowledge of relaying principles of electro-mechanical, static and numeric relays.
5. design protection schemes using over current, earth fault and directional relays and to calculate the relay settings.

6. design appropriate protection schemes for generators and transformers.
7. apply electromechanical, static and numeric distance relays for protection from distance faults.
8. analyze relay records and determine the cause of failure after a protective relay operation.

Outline Syllabus

1. Power system stability
   Steady state stability: Power angle characteristics, swing equation, effect of AVR and governor. Transient stability: Equal area criterion, stability under fault conditions, step by step solution of swing equation. Voltage stability.
2. Introduction to power system protection
   Necessity for protection, Historical development, General requirements of protective relaying, Unit and non-unit protection, primary and backup protection
3. Instrument transformers
   Current and voltage transformer: principles and applications, steady state operation, equivalent circuit, errors, accuracy limits and classes of CTs and VTs.
4. Types of relays and relaying principles
   Operating principles of electro-mechanical, static and numeric relays. Basic structure of protection systems, rated current, voltage and setting of relays, operation of basic relay types.
5. Relay coordination
   Principles of over current protection, discrimination by time, current, time and current, inverse characteristics, discriminative grading, characteristic presentation, earth fault detection, sensitive earth fault protection, theory and operation of directional over current, earth fault relays and their applications.
6. Transformer and Generator protection
   Types of transformer faults, principles of transformer protection, generator faults, principles of generator protection.
7. Distance protection
   General principles, relationship between primary and secondary impedance, zones, distance relay performance, distance relay inputs, switched and non switched distance relays, characteristic presentation, numeric distance relays, distance relay schemes with co-ordination of communication facilities.
8. Busbar and feeder differential protection
   Application of Merz-Price principle, current balance and voltage balance schemes, summation current transformers, differential relay performance, numeric feeder differential relays, basic requirements and types of busbar protection schemes, introduction to slow and high speed auto reclosing, failure analysis.

Module Code	**EE3053**	Module Title	**Power Electronics and Applications I**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE3183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To learn about different power switching devices, their features, application considerations and relevant design calculations.
2. To learn about single-phase and three- phase ac to dc/dc to ac converters of different types, their construction, operation, control, applications and critical evaluation.

3. To learn about dc voltage regulators of different types, their operation, control and application aspects.
4. To learn about ac-dc thyristor converters in high power applications, their operation, calculations and assessment of the impacts on utility system.

Learning Outcomes:
After completing this module the students should be able to

1. select the most appropriate power switching devise for a given design.
2. assemble single and three phase ac to dc converters and test them.
3. identify problems of harmonics and distortions at ac input due to the operation of ac to dc converters and take corrective measures.
4. construct different types of dc to ac inverters and apply them selectively to solve practical problems.
5. develop control circuits/software to operate an inverter in given PWM, or square switching mode.
6. perform calculations in ac to dc and dc to ac converters and ac voltage regulators

Outline Syllabus

1. Power semiconductor switching devices
   Overview of Power Diodes Thyristors, BJTs, MOSFETs, IGBTs and other hybrid devices, switching characteristics, ratings, drive circuits.
2. AC to DC converters
   Single and three phase converters using diodes and /or thyristors, effects of smoothing capacitor, operation with inductive loads, control of output voltage, line notching, inverted operation, margin-angle.
3. DC to AC inverters
   Single and three-phase voltage source inverters, square-wave and different PWM types, implementation, harmonics, output filtering, voltage and frequency control, applications in industry.
4. AC voltage regulators
   Static ac voltage regulators for low and high power applications.

Module Code	**EE4203**	Module Title	**Design Project**			
Credits	**5.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**-**		

Module Objectives

1. Enhance the creativity in design.
2. Enhance the real world implementation skills of an Engineering problem.
3. Introduce research and development.
4. Promote self learning and group working skills.
5. Promote practice.

Learning Outcomes
After completing this module the student should be able to

1. design and implement an engineering project.
2. develop specific skills in project definition, planning and scheduling.
3. present technical ideas in written and oral form effectively.
4. apply realistic constraints and engineering standards in a project.
5. propose new ideas as needed to meet the goals of a project.

Outline Syllabus

1. Design and develop a complete engineering project.
2. Demonstrate and present the result.

Module Code	**EE4183**	Module Title	**Laboratory Practice VI**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. appreciate and apply electrical safety procedures.
2. demonstrate knowledge of high voltage equipment and systems as applied in the industry.
3. demonstrate knowledge of automation and control systems as applied in the industry.
4. demonstrate knowledge of power electrical installations as applied in the industry.
5. demonstrate knowledge of electrical machines as applied in the industry.
6. demonstrate knowledge of power systems as applied in the industry.

Outline Syllabus

This module consists of Semester 7 Electrical Engineering Laboratory experiments in the areas of,

1. High Voltage Engineering I
2. Electrical Machines & Drives III
3. Power Systems III
4. Power Electronics & Applications I

Experiments may cover more than one area and would be conducted as part of a system.

Module Code	**EE4903**	Module Title	**Field Visit**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**NGPA**		Lab/Assignment	–		

Module Objectives

1. Enhance the practical knowledge through industrial visits, interaction with professional engineers and continuous improvement of practical knowledge through experience.

Learning Outcomes

After completing this module the student should be able to

1. demonstrate the correlation between theory and its application.
2. apply multidisciplinary approach to engineering projects.
3. exhibit solidarity among student to emerge as a team.

Outline Syllabus

1. Group visits to places such as power stations, switch yards, electrical installations, electrical manufacturing plants, renewable energy plants.
2. Preparation of report.

Module Code	**EE4243**	Module Title	**Nuclear Power Engineering**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To teach the students the principles of nuclear power generation to enable them to appreciate the pros and cons of nuclear power in the Sri Lankan context and to facilitate further training if the need to use nuclear power arises in the future.

Learning Outcomes

After the completion of the course the student should be able to

1. develop an understanding of the basis of radioactivity and nuclear power generation
2. develop an understanding of the methods of detecting and measuring radiation
3. appreciate the biological effects of radiation and the precautions to be taken to minimize exposure
4. develop and understanding of how nuclear energy is used to generate electrical power in different types of power plants
5. develop and understanding of the different aspects of nuclear power generation in Sri Lankan context
6. use the knowledge gained to obtain further training on specific aspects of a nuclear power programme.

Outline Syllabus

1. Basic Nuclear Physics
   Atomic Structure and radioactive decay, Nuclear Reactions and Cross Sections, Mass Defect and Binding Energies.
2. Radiation Measurements
   Gas-filled and Scintillation Detectors, Single Channel and Multi-channel Analyzers, Counting Statistics
3. Radiation Protection
   Sources of Radiation, Biological Effects, Dose Estimation, and Principles of Radiation Protection.
4. Nuclear Power Plants
   Main Components of Nuclear Power Plants, Pressurized Water Reactors, Boiling Water Reactors, Pressurized Heavy Water Reactors
5. Nuclear Safety
   What can go wrong, levels of safety, physical barriers, past accidents
6. Nuclear Power in Sri Lankan Context
   Constraints, Factors to be considered, Phases and Milestones of Nuclear Power Projects

Module Code	**EE4213**	Module Title	**Robotics and Mechatronics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. Introduce the systems integrated approach in modern mechatronics
2. Introduce history of robotics and mechatronics
3. Develop the capability in analysing a given robot system using kinematics and dynamics.
4. Design and develop a robot for a specific task.

Learning Outcomes
After completing this module the student should be able to

1. develop an understanding of the basic concepts involved in Robotics.
2. recognise the value of Integrated knowledge over several disciplines for the present day Robotics systems
3. design and fabricate a simple Robot/Mechatronics system

Outline Syllabus

1. Introduction
   History of Robotics and Mechatronics, Different disciplines of Robotics, What to be expected in the future.
2. Kinematics and Kinetics of Machines
   Practical movements in 2D/3D, Rigid motions and homogeneous transformation, Forward and Inverse Kinematics, Velocity Kinematics Jacobian
3. Path and Trajectory Planning
4. Dynamics
5. Control and Sensing aspects in robotics and mechatronics
   Sensors and Actuators for robotics, Introduction to Artificial Intelligence, Microprocessor based Controllers, Vision based controllers.

Module Code	**MN 4042**	Module Title	**Technology Management**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	–		

Module Objectives
The objective of this module is to impart to the students:

1. The ability to understand principles of Technology Management
2. The ability to understand the vitality of the technology management for success of engineering projects.

Learning Outcomes

1. To recognize basic concepts and theories of management of technology.
2. To identify the usage of MOT concepts and theories in modern organizations and economy.

Outline Syllabus
Concept of technology Management

1. Strategic management of technology; (4 hrs)
   Technology-strategy relationship.
   Elements of technology strategy and formulation of a technology strategy.
   Integration of technology strategy and business strategy for competitive success.
   Technology, the environment and sustainable development.
2. Organizational Aspects of technology management; (4 hrs)
   Human dimension of technology and concepts of the entrepreneur and entrepreneur.
   Organizational cultures and structures for promotion of creativity and innovation.
   The learning organization.
   The imperative of knowledge management.
3. Acquiring technology through technology transfer; (3 hrs)
   Motivations for acquiring technology through technology transfer.
   Elements of technology transfer process.
   Success and failure factors in technology transfer.

4. Acquiring technology through research and development; (3 hrs)
   The concepts of invention and innovation.
   Definition and classifications of research and development.
   New product development.
   Challenges in commercializing research results.
5. National innovation systems for facilitating technology-based development (4 hrs)
   Concepts of the national innovation system (NIS) and science and technology infrastructure**.** Comparison of NISs of developed, developing and first and second tier NIC countries.
   State involvement and growth of science and technology parks in developed and developing countries.
6. Practicals
   Four industry case studies, Two plant/laboratory visit.

Module Code	**MN 4022**	Module Title	**Engineering Economics**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**–**		

Module Objectives
The objective of this module is to impart to the students:
1. The ability to understand principles of engineering economics.
2. The ability to carry out economic analysis of engineering projects.

Learning Outcomes
1. To identify the most relevant economic concepts for the engineering decisions.
2. To apply these concepts to practical engineering projects and decisions.

Outline Syllabus
1. Fundamentals
   Time value of money, equivalence and cash flow diagrams.
2. Discounted cash flow
   Time value equivalence, single payment and annuity factors and numerical examples. Cash flows and compounding.
3. Comparison methods
   Assumptions, net present value, annual worth, equivalent annual cost with/without salvage value, equivalent annual worth of fixed asset lives and perpetual lives, internal rate of return (IRR) and minimum acceptable rate of return and IRR irregularities, numerical examples.
4. Analysis of alternatives
   Classification, mutually exclusive alternatives, incremental analysis and preferred method for decision making.
5. Project feasibility analysis
   Financial feasibility, market price analysis, cost of capital and weighted average, economy feasibility, shadow pricing, benefit cost (B/C) analysis, irregularities of B/C analysis and preferred method for decision making.
6. Sensitivity analysis and decision trees
   What if?, sensitivity graph and interpretation of the analysis, discounted decision trees and application of decision trees.
7. Risk management
   Risk identification, risk analysis and risk response.

Module Code	**MN3020**	Module Title	**Entrepreneurship Business Basics**			
Credits	**3.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Learning Objectives

1. To provide students with an introduction to financial management for entrepreneurs, concepts such as cash flow, financial statements, financial ratios, time value for money, capital budgeting and net present value.
2. To provide methods to secure entrepreneur's intellectual property, including patents, trade-marks, copy rights and trade secrets.
3. To provide an opportunity to analyze an industry and to develop new products/services along with marketing tactics and strategies.
4. To provide students with basic understanding about Human Resource Management functions for recruiting and maintaining talented and committed work force.

Learning Outcomes

After completing this module the student should be able to

1. demonstrate understanding of fundamentals ideas of financial management for entrepreneurs, concepts such as cash flow, financial statements, financial ratios, time value for money, capital budgeting and net present value.
2. go through the process of securing entrepreneur's intellectual property, including patents, trademarks, copy rights and trade secrets.
3. analyse an industry and identify opportunities for new products/services along with marketing tactics and strategies.
4. identify human resource needs for an organization and acquire and maintain required people.

Outline Syllabus

1. Overview of Corporate Finance: Introduction to corporate finance; Financial statements/taxes/cash flow.
2. Financial statements and long-term financial planning: Working with financial statements and real world applications; Long-term financial planning and growth
3. Valuation of cash flows: Time value for money; Net present value
4. Risk management; Risk identification, risk analysis and risk response;
5. Patents, trade secrets and copy rights: Introduction to business law; Patents and procedure for obtaining patents; Trade secrets, copy rights and trade marks
6. Marketing: Introduction to marketing; Consumer behavior; Business and organizational consumers; Production development and management; Pricing objectives and policies; Business ethics; Advertising and sales promotion; Integrated marketing communications.
7. Managing Human Resources; Introduction to Human Resource Management; Manpower planning; Job Analysis and designing; Recruiting and selecting appropriate human capital; Staffing and training people; Reward management; Grievance handling; Transfers promotions and retirements
8. Managing Operations; Designing new products and processes, Demand forecasting, Planning for production facilities, Production planning, Managing inventories, Managing productivity and quality

Module Code	**MN4030**	Module Title	**Strategic Enterprise Management**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/2**		

Learning Objectives

1. To cultivate the strategic thinking among the students which is of primary importance in managing entrepreneurial organizations, exploiting opportunities and addressing complex issues in the turbulent business environment.

Learning Outcomes

After completing this module the student should be able to

1. appreciate the complexity of crafting strategies within turbulent and complex environment.
2. inculcate strategic thinking in to the entire strategic management process of an organization
3. preview the environment realistically, craft strategies practically, and select the best strategies among the alternatives and successfully implement those for the sustainable success
4. prepare, monitor, critique, an edit strategic plan/ corporate plan of an organization.

Outline Syllabus

1. The role of Strategies in an Entrepreneurial Business
2. Understand and effectively assess these strategic challenges
3. Mind of the Strategist: A critical review of Strategic Thinking
4. Setting the future: Corporate Philosophy, Vision, Mission, Goals and Objectives
5. What is Environment I: Positioning your organization in your environment
6. What is Environment II: Assessing strategic capability of your organization
7. Strategic Option: Corporate, Business and Functional Strategies
8. Assessing/ Evaluating Strategies: Balance Score Card, GE's Nine Cells, SPACE Matrix, Strategy Clock
9. Strategy Implementation: Strategy, Culture and Leadership
10. Strategic Control and Review .

Semester 8

Module Code	**EE4023**	Module Title	**High Voltage Engineering II**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Co-requisites	**EE4093**
GPA/NGPA	**GPA**		Lab/Assignment	**3/2**		

Module Objectives

1. To analyse the behaviour of transmission lines in the presence of transients and to be able to protect them.
2. To test insulation to satisfy needs of high voltage engineering.
3. To co-ordinate insulation in the transmission system.

Learning Outcomes

At the end of the module, the student should be able to

1. analyse transients in high voltage transmission lines.
2. measure high voltages used for testing and do calibrations on testing equipment.
3. observe high voltage fast transients on an oscilloscope without distortion.
4. calculate the dielectric constant and dissipation factor of dielectrics.
5. analyse circuits producing high voltages for testing purposes.
6. apply alternating, direct and impulse high voltages to equipment under test.
7. co-ordinate impulse insulation levels in the transmission system.

Outline Syllabus

1. High Voltage Transient Analysis
   Surges on Transmission Lines: Surge Impedance and Velocity of Propagation, Reflection and Transmission of Travelling waves, Bewley Lattice Diagram. Representation of Lumped Parameters. Digital computer implementation. Transform Methods of solving Transients.
2. Measurement of High Voltage
   Direct Measurement of High Voltages: Electrostatic Voltmeters, Sphere gaps. Transformer and potential divider methods of measurement. Matching of Potential dividers. Measurement of Surges. General measurements: Peak reading voltmeters, Oscilloscope for measurement of fast transients. Measurements of capacitance permittivity and dissipation factor. Detection of internal discharges.
3. High Voltage Generators for Testing
   Generation of High Alternating Voltages: Cascade arrangement of transformers, Resonant Transformers. Generation of High Direct Voltages: Rectifier circuits, Voltage Multiplier Circuits, Electrostatic generators.
4. High Voltage Surge Generators
   High Voltage Impulse Generators: Single exponential waveform, Double exponential waveform, Calculation of coefficients from resistance and capacitance values. Definition of Wavefront and Wavetail, Types of practical waveforms. Operation of the Marx Impulse Generator. Generation of chopped impulse waveforms.
5. High Voltage Testing
   General tests carried out on High voltage equipment. Testing of solid dielectric materials. Type tests, Sample Tests, Routine Tests. Tests on typical high voltage equipment.

Module Code	**EE4043**	Module Title	**Electrical Machines and Drives IV**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE4183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To be able to design and implement induction motor drives and synchronous motor drives for the industry applications and to upgrade the existing motor drives for new industrial environments

Learning Outcomes

After completing this module the students should be able to

1. design and implement a three-phase induction motor drive system covering wide speed range.
2. distinguish between adjustable speed and servo grade induction motor drives.
3. identify components in an induction motor drive system and their functions.
4. revise rating plate of a motor for new operating environment.
5. select the kW rating of a motor to function in a known load cycle.
6. perform temperature rise calculations for a motor operation.
7. identify where and how to apply synchronous motor drives in industry.
8. perform short circuit transient calculations to estimate generator parameters and select rating for the generator breaker.

Outline Syllabus

1. Three-phase induction motor drives
   System structure, variable voltage variable frequency control, initial voltage boosting, high speed control, slip regulation and direct current limiting techniques, ramp limiters, independent flux and current control (field oriented control), closed loop drives, co-ordination between motor and power electronic inverter, voltage and current waveforms at low and high speeds, multi-quadrant operation.
2. Operational aspects
   Rating plate data, safe operation, temperature rise calculations, sizing of motors for given load cycles, general and special purpose motors.
3. Synchronous motor drives
   Large synchronous motor drives using load commutated inverters, self controlled synchronous motor drives.
4. Transient performance of synchronous generators
   Subtransient, transient, and steady state reactance and time constants, sudden short circuit current analysis, parameter estimation using short circuit oscillogram, sudden open circuit performance, slip test.

Module Code	**EE4053**	Module Title	**Power systems IV**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE4183**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To understand the advanced concepts of monitoring, operation and control of electrical power systems including economic and management aspect.
2. To acquire knowledge of emerging trends in systems used for Power system Operation and Control.

Learning Outcomes

After completing this module the student should be able to

1. contribute positively towards the operation of a power system with the understanding gained in the operation and control of power systems.
2. design an optimal operation setup for the power system whilst meeting the desired needs.
3. analyze the problems associated with the power industry in a country and be a knowledgeable participant in a team of regulators.
4. demonstrate the knowledge of methodologies used to evaluate generation, transmission and distribution system reliability and to plan power systems to meet the benchmarks on system adequacy, security etc.
5. model a power system using at least one industry recognized software and to carry out the basic studies. Carrying out the necessary studies and prepare reports.
6. demonstrate knowledge of power system stability phenomena and use the stability study results to improve power system performance.

Outline Syllabus

1. Power system control
   Load Control & Frequency Stability, Automatic Load Frequency Control, AVR and Voltage Control, Reactive Power Control. Dynamic model of a governor, different governors in power plants, primary load frequency control, concept of control area. AVR System, voltage profile & power transfer, voltage control of generators and droop settings, step up transformers and voltage injection.
2. Power system modelling
   Dynamic model of Power System, ALFC Control, Control techniques (PI, PID, Modern Control), Synchronous and asynchronous interconnections, use of PSCAD for system modeling.
3. System stability and load shedding
   Effect on system stability by adding generators and loads, load shedding criterion and design of load shedding scheme.
4. HVDC Transmission
   High voltage direct current transmission over long distances.
5. Power system planning and reliability
   Introduction to long term planning, reliability, probabilistic production costing.
6. Power system economics
   Economic operation of power systems: load dispatch with power system constraints, merit order dispatch, use of Lagrange multipliers and penalty factors.
7. Power sector restructuring, regulation and competition
   Restructuring of the electricity industry, alternative structures, types of regulation, relationship between competition and regulation, International and local experience.

Module Code	**EE4063**	Module Title	**Power Electronics and Applications II**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Co-requisites	**EE4193**
GPA/NGPA	**GPA**		Lab/Assignment	–		

Module Objectives

1. To provide with the knowledge required to understand the operation and the behaviour of converter circuits producing DC output
2. To develop the ability to design power electronic converter system and simulate
3. To focus on selected power electronic applications.

Learning Outcomes
After completing this module the students should be able to

1. build different types of DC to DC converters and their control circuits.
2. assemble multi stage power conversion systems involving all AC to DC converters.
3. carry out reliable designs of power electronic systems to meet given specifications.
4. carry out testing and troubleshooting of power electronic systems.
5. construct industry standard power electronic products and provide documentation.
6. apply power electronics to solve problems in such areas as power systems, process industries, motion control systems etc. And build products with commercial motives.

Outline Syllabus

1. DC to DC converters
   Isolated and non isolated converters of different types, output voltage regulation, steady state analysis, switch mode power supplies.
2. Design of power electronic converters
   Selection of voltage and current ratings, deciding on switching frequency, protection of power devices against over voltage, over current, thermal build up, switching stresses, spurious triggering, shoot-through fault etc., circuit protection, design of drive circuits, isolation of control signals, component selection, testing, circuit fabricating ethics, control circuit interface, use of power integrated circuits, application specific integrated circuits and programmable integrated circuits, product architecture, documentation.
3. Simulation of power electronic systems
   Use of standard simulation packages.
4. Applications
   Details of selected applications of power electronics in power systems, industrial processes, motion control systems, power supplies, artificial lighting etc.

Module Code	**EE4203**	Module Title	**Design Project** (Continued from Semester 7)			
Credits	**5.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**-**		

Module Objectives

1. Enhance the creativity in design.
2. Enhance the real world implementation skills of an Engineering problem.
3. Introduce research and development.
4. Promote self learning and group working skills.
5. Promote practice.

Learning Outcomes
After completing this module the student should be able to

1. design and implement an engineering project.
2. develop specific skills in project definition, planning and scheduling.
3. present technical ideas in written and oral form effectively.
4. apply realistic constraints and engineering standards in a project.
5. propose new ideas as needed to meet the goals of a project.

Outline Syllabus

1. Design and develop a complete engineering project.
2. Demonstrate and present the result.

Module Code	**EE4193**	Module Title	**Laboratory Practice VII**			
Credits	**1.0**	Hours/Week	Lectures	**-**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Module Objectives

1. To perform as a team member in finding solutions for given complex Engineering problems using the theoretical knowledge, research methods and available resources and to produce valid individual conclusions for the given problem.

Learning Outcomes

After completing this module the student should be able to

1. appreciate and apply electrical safety procedures.
2. demonstrate knowledge of robotic and mechatronics as applied in the industry.
3. demonstrate knowledge of power electronics as applied in the industry.
4. demonstrate knowledge of power systems as applied in the industry.
5. demonstrate knowledge of electrical machines as applied in the industry.

Outline Syllabus

This module consists of Semester 8 Electrical Engineering Laboratory experiments in the areas of,

1. High Voltage Engineering II
2. Electrical Machines & Drives IV
3. Power Electronics & Applications II
4. Power Systems IV

Experiments may cover more than one area and would be conducted as part of a system.

Module Code	**EE4223**	Module Title	**Renewable Energy and the Environment**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**–**		

Module Objectives

The objective of this module is to impart to the students

1. The ability to understand the problems associated with conventional power generation.
2. The ability to analyse various renewable energy technologies.
3. The ability to understand the barriers for the development of renewable power plants.

Learning Outcomes

After the completion of the course the student should be able to

1. assess the environmental Impacts caused by indiscriminate operation of conventional energy supply systems.
2. appreciate the necessity to move towards sustainable energy resources with minimum impact on the environment.
3. evaluate the present status of renewable energy development in the world / Sri Lanka.
4. compare different non conventional renewable energy technologies, their efficiencies, resource assessment and capital as well as operational costs.
5. identify the barriers to commercial development of large scale renewable projects.

Outline Syllabus

1. Environmental impacts of energy projects
   Impacts of fossil fuel based energy systems on the environment and human life. Global warming. Extreme weather.

2. Sustainable energy supplies
   Sustainable and renewable energy sources and projects. Their impacts on the environment.
3. Present status of renewable energy development
   Global status of renewable energy technology development. Targets set by government energy policies and initiatives.
4. Renewable energy technologies
   Present day technologies used in harnessing Small hydro, Wind, Solar, Biomas, Geothermal, Tidal power etc. Resource assessment, the efficiencies of energy conversions, costs of development and operation.
5. Battery technologies
   Types of batteries, capacities, Specific energy densities, fuel cells, battery technologies for renewable options.
6. Regulatory structure
   Regulatory structure for developing renewable energy projects for electricity generation. Tariffs available for developers. Net metering.

Module Code	**EE4233**	Module Title	**Real-time Computer Systems**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**–**		

Module Objectives
1. To understand the principles of realtime operation of computer systems.
2. To be able to design realtime control system for industrial systems.
3. To understand the requirements of hardware and software for realtime systems.

Learning Outcomes
After completing this module the student should be able to
1. design a real-time control system for industrial control.
2. program and implement hardware necessary for real-time control.
3. design software for mission critical applications.

Outline Syllabus
1. Real-time operating systems
   Computer architecture, microprocessor programming, concurrency, interrupts, process management, memory management, virtual memory, input/output, deadlocks, synchronisation and mutual exclusion.
2. Development of mission critical software.
3. Hardware and software for industrial control.
4. System integration.

Module Code	**MN4072**	Module Title	**Small Business Management and Entrepreneurship**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	**–**		

Module Objectives
1. Students should be able to describe the framework of small business management and to identify the necessary skills.

Learning Outcomes

1. To describe the theoretical and empirical framework of small business management.
2. To explain the applications of these concepts & theories for own business. To identify the necessary skills to become a successful entrepreneur.

Outline Syllabus

1. Small Business Management
   Scale, nature & role of small business in a developing country;
   - Characteristics of small businesses;
   - Role of small businesses;
   - Reasons for failure of small businesses & barriers in establishing and managing small businesses.

   Business environment and industrial supporting system in Sri Lanka.
   Relevant concepts to understand business creation and growth such as;
   - Identification of market opportunities;
   - Developing a business plan;
   - Managing small business operations
   - Marketing in small businesses
2. Entrepreneurship
   Identifying who the entrepreneur is;
   - Definition;
   - Relevant economic, psychological and sociological theories of entrepreneurship;
   - Characteristics and functions of the entrepreneur;
3. Entrepreneurship development;
4. Practical: 6 industrial case studies, guest lectures and assignments

Module Code	**MN4092**	Module Title	**Management Skills Development**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignments	–		

Module Objectives

1. Students should be able to practice capabilities in intra-personal, interpersonal and people management skills.

Learning Outcomes

1. To practice and demonstrate capabilities in intra-personal, interpersonal and people management skills that are required in modern organizations.

Outline Syllabus

1. Intra-personal Skills
   Developing self awareness; Values, cognitive style. Attitude towards change and interpersonal orientation;
   Managing stress; Major elements of stress, eliminating stress and temporary stress reduction techniques;
   Effective problem solving skills; to provide a framework for rational problem solving;
2. Interpersonal Skills
   Supportive communication; definition, principles of supportive communication, principles of supportive listening;
   Motivating employees; performance, diagnosing work performance problems and enhancing ability, creating a motivating environment;

Managing conflict; interpersonal conflict management, conflict response alternatives and collaborative approach for conflict resolution;

3. People Management Skills
   Leadership; characteristics, styles of leadership, contingent approach and its variable;
   Empowerment; inhibitors to empowerment, dimensions of empowerment and developing empowerment;
   Delegation; advantages of delegation, when and whom to delegate and how to delegate effectively;
   Teamwork; developing teams and teamwork, advantages of teams and stages of team development.

Module Code	**MN4122**	Module Title	**Human Resource Management and Industrial Relations**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	None
GPA/NGPA	**GPA**		Lab/Assignments	–		

Learning Outcomes
After completing this module the student should be able to

1. acquire and develop capabilities in human resource management concepts and application.

Learning Outcomes

1. Acquire and develop capabilities in human resource management concepts and application.

Outline Syllabus

1. Human Resource Management
   - Role of the human resource function and practitioner.
   - Organization, jobs and roles.
   - Employee resourcing.
   - Performance management.
   - Human resource development.
   - Rewarding people.
2. Industrial Relations
   - Labour – Management relations in Sri Lanka.
   - Industrial dispute.
   - Trade unions.
   - EPF, ETF and Gratuity acts.
   - Work place health, safety and welfare.
   - Business ethics.

Module Code	**MA4023**	Module Title	**Operations Research**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**MA1013**
GPA/NGPA	**GPA**		Lab/Tutorials	–		

Learning Outcomes
At the end of the course the student should be able to

1. identify appropriate OR techniques in a given real world problem.
2. perform sensitivity analysis in the chosen OR model.

3. choose an appropriate algorithm for the given the OR technique.
4. use the TORA software for engineering problems.

Outline Syllabus

1. Modeling with linear programming, geometrical solution to problems with two decision variables, simplex method including Big M-method and two phase method of a solution of problems with mixed constraints.
2. Duality in linear programming, Transportation and assignment problems, trans-shipment problems. Theory of zero sum, two person matrix games.
3. Revised simplex algorithm. Dual simplex algorithm, sensitivity analysis, and parametric programming.
4. Integer programming, Gomory's cutting plane, branch and bound, the knapsack problem.
5. Dynamic programming, the inventory model. Non-linear optimization.
6. Introduction to network algorithm including minimum connector problems: Shortest and longest path algorithms and critical path analysis. PERT model.

Module Code	**MA4033**	Module Title	**Time Series and Stochastic Processes**			
Credits	**3.0**	Hours/Week	Lectures	**3.0**	Pre-requisites	**MA1023 MA3013**
GPA/NGPA	**GPA**		Lab/Tutorials	**–**		

Learning Outcomes

At the end of this module the student should be able to

1. choose the appropriate time series modelling technique for a given data.
2. use Minitab and Eviews software to analyse time series data.
3. apply Markov chain techniques in modelling uncertain physical systems.
4. apply Stochastic modelling techniques in engineering applications

Outline Syllabus

1. Time Series
   Trend analysis, smoothing techniques, decomposition techniques. Properties of various statistical time series processes. Basic theory of stationary processes: AR, MA, and ARMA models; Seasonal adjustment. Use of Minitab and Eviews Software in time series data.
2. Stochastic Process
   An introduction to stochastic processes. Stationary distributions. Markov chains. Homogeneous Poisson process, Birth-death process, queuing theory.

Module Code	**MN4010**	Module Title	**Business Plan Development**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Learning Objectives

1. To improve students' knowledge and skills in planning their own future businesses and documenting for the purpose of communicating the business idea in formal and attractive manner for third party funding organizations.

Learning Outcomes
After completing this module the student should be able to
1. exploit business opportunities
2. prepare a marketing plan
3. prepare a production plan
4. prepare a human resource plan
5. prepare a finance plan
6. write and present a business plan attractively.

Outline Syllabus
1. Introduction to the Business Plan
2. Marketing Planning
3. Production Planning
4. Planning for HR
5. Planning for Finance
6. Writing a Business Plans
7. Presenting a Business Plan for donors and other related institutions

Module Code	**MN4170**	Module Title	**Global Entrepreneurship**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**3/1**		

Learning Objectives
1. To motivate students to play the role of an entrepreneur/intrapreneur in the global context with proper understanding on international business environment.

Learning Outcomes
After completing this module the student should be able to
1. appreciate and discuss contemporary global business concepts relating to culture and communication in a way that facilitates practical application in real world international engineering, business, social, and other professional settings
2. be aware of the global current events, business/leadership skills, cultural iq, and communication strengths and weaknesses
3. demonstrate/practice advanced cultural cognizance and cross-cultural communication
4. have a greater appreciation for and desire to pursue a global career or run a global business.

Outline Syllabus
1. Global business in its historical, theoretical, environmental, and functional dimensions
2. Culture, globalization and international business
3. Business across cultures
4. Global leadership
5. International trade
6. International human resource management
7. International Financial Management
8. Virtual business organizations and virtual teams
9. International Communication

Module Code	**MN4112**	Module Title	**Production and Operations Management**			
Credits	**2.0**	Hours/Week	Lectures	**2.0**	Pre-requisites	**None**
GPA/NGPA	**GPA**		Lab/Assignment	**-**		

Learning Objectives

1. To provide the knowledge on how enterprises should design, plan, manage and improve their operations in order to achieve, sustain, and strengthen their competitive advantage by enhancing customer value.

Learning Outcomes

After completing this module the student should be able to

1. design an efficient and effective operations system to give required output.
2. use operations management techniques and tools to plan and control the activities of operations system.
3. develop and implement the programmes for improving the operations system.

Outline Syllabus

1. Introduction to Production & Operations Management, Operations Strategy
2. Product & Process Design
3. Strategic Capacity Planning
4. Location and Layout Planning
5. Work Organization and Job Design
6. Supply Chain Management
7. Demand Forecasting
8. Aggregate Production Planning
9. Inventory Control
10. Manufacturing Resource Planning (MRP, MRPII, ERP), Just-In-Time Operations
11. Operations Scheduling
12. Quality Management

Humanities Modules

The Humanities modules students have to select during Semesters 2 and 4, numbered DE1XXX and DE2XXX, are managed by several Departments in the Faculty of Engineering. Offering of these modules changes from year to year subject to the availability of lecturers and physical resources. A list of modules being offered in the current Semester is maintained by the Undergraduate Studies Division of the Engineering Faculty. You may consult their web page *http://www.mrt.ac.lk/eugs/* for the most current syllabi of the humanities modules.

Service Course

(Not available to Electrical Engineering field of specialisation)

Module Code	**EE2803**	Module Title	**Applied Electricity**			
Credits	**2.0**	Hours/Week	Lectures	**1.5**	Pre-requisites	**EE1013**
GPA/NGPA	**GPA**		Lab/Assignment	**3/2**		

Learning Outcomes

After completing this module the student should be able to

1. calculate electric transformer or motor performance under variety of load conditions,
2. select a suitable electric motor for a given application,
3. demonstrate basic knowledge in electricity utilisation in the areas of lighting, heating and welding,
4. understand wiring regulations applicable to households,
5. carry out simple voltage drop calculations for cables,
6. estimate monthly electricity bill for an installation and methods of minimising the cost of electricity.

Outline Syllabus

1. Transformers
   Single Phase transformers, EMF equation, equivalent circuit & phasor diagram, losses & efficiency, voltage regulation, test on transformers, use of three phase transformers.
2. Induction motors
   Types of rotors and windings, induction motor action, torque speed characteristics, losses and efficiency, starting and speed control, ratings and applications. single phase induction motors and their applications.
3. D.C. machines
   Equivalent circuits, motor and generator operation, characteristics of series, shunt and compound motors, starting and speed control, industrial applications.
4. Special purpose motors
   Universal motors: constructional and operational characteristics. Stepper motor operation and types, applications.
5. Solid state control
   Introduction to solid state control of dc and ac motors, principles of four-quadrant operation.
6. Electric lighting
   Basic principles, characteristics of light, lamps and luminaires, average lumen method of lighting calculations.
7. Heating and welding
   Methods of heating: Joules, induction and dielectric. Industrial applications. Electric welding: types, requirements, welding transformers.

8. Electrical wiring
   Wiring regulations, circuits and wiring symbols, selection and voltage drop calculations of cables. Earthing.
9. Economics of power Utilisation
   Cost of electric power: fixed, variable and maximum demand charges, tariffs. Demand management: power factor correction.

Electrical Engineering Society – EESoc

Electrical Engineering Society (EESoc) is a group of progressive power people from University of Moratuwa, who aim to produce dynamic personnel in the field of Electrical Engineering. EESoc was inaugurated on the 27th October 1994 with Professor Rohan Lucas as its founder President. While still being a very young society, EESoc's achievements are so impressive because all of us always "Try for Excellence ".

EESoc is blessed with warm thoughts, simple pleasures, and simple joys. We believe that happiness comes from feeling deeply, enjoying simply and thinking freely. EESoc knows that all the power products of University of Moratuwa are still up there, all exactly where they are supposed to be. The EESoc Calander includes the following events which take place at regular intervals.

- Panel Discussions
- We are with you program
- EESoc award for best project
- EESoc Lecture series

Panel Discussions

The EESoc annually organizes panel discussions on topics of national relevance related to electrical engineering, with the participation of eminent electrical engineering professionals. The outcomes of these deliberations are conveyed to policy makers, in the form of recommendations. The panel discussions expose the undergraduates to the real world and give them an opportunity to develop insights into current issues related to their chosen field.

We are with You

We are with You is a very special social responsibility program organized by EESoc for the benefit of deaf students. It is sad that the community has forgotten the importance of these young children, and they often do not get involved in common functions. They are like all the other ordinary children in every other way, only thing they lack is, that they don't hear as we do and they can't express themselves in the ordinary way of talking. Yet they are skilled in many other ways like in studies, in painting and other creative work, in sports etc. Though the Schools for deaf are funded by various organizations, what these students lack are the thoughts of love and caring from the community.

Several entertainment programs as well as educational programs are organized for the students, during their visit to the campus, including an art exhibition, magic show, sports carnival and a movie session.

The origins of this programme dates back to the time of Miss Indunil Weeraratne. While being an Electrical Engineering Student she and a group of friends in the year 2000 organized a programme at the Ratmalana School for the Deaf. Since then the event has been taken over by the Electrical Engineering Society on her request, and organized annually with the participation of other deaf schools.

EESoc Award for Best Project

The Electrical Engineering Society has donated an award for Excellence in Performance of the Final Year Undergraduate Project in Electrical Engineering. This award is annually given at the Academic Award Ceremony of the University of Moratuwa to selected students from the Department judged by the Electrical Engineering Department as the best undergraduate project during the year. The award was inaugurated by the 1992/93 Final year students.

EESoc Lecture Series

EESoc organises a monthly lecture series, to provide assistance in updating the knowledge of our members with new technology. Guest speakers from the industrial sector and from the other universities are invited regularly to share their thoughts, knowledge and expertise with the students.