Remain at the cutting edge of electronics engineering
Participate from your home and office through innovative, live e-learning
Meet up with world renowned experts in electronics engineering
Join the next generation of electronics engineers

WHAT YOU WILL GAIN:
• Skills and know-how in the latest technologies in electronics engineering
• Practical guidance from electronics engineering experts in the field
• 'Hands on' knowledge from the extensive experience of the lecturers, rather than from only the theoretical information gained from books and college reading
• Credibility as an electronics engineering expert in your firm
• Networking contacts in the industry
• Improved career prospects and income
• An EIT Advanced Diploma of Industrial Electronics Engineering

For more information or to enrol, please contact enquiries@eit.edu.au

** A note regarding recognition of this program in the Australian education system: EIT's sister company, IDC Technologies, is the owner of this program, which is officially accredited within the Australian Qualifications Framework by the Training Accreditation Council (WA). An application is to be submitted to the Australian Skills Quality Authority (ASQA) for this program to be registered for delivery by the EIT (that is, added to the EIT's "scope") in all Australian states. The EIT will deliver this program to students worldwide. On the date when the program information shown here was published the application to ASQA was pending, therefore the program start date shown is provisional pending formal registration with ASQA
Introduction

Join the next generation of electronics engineers and technicians and embrace a well paid, intensive yet enjoyable career by embarking on this comprehensive and practical program. It provides a solid overview of the current state of electronics engineering practice and is presented in a practical and useful manner - all theory covered is tied to a practical outcome. Leading electronics engineers present the program over the web using the latest distance learning techniques.

There is a great shortage of electronics engineers and technicians in every part of the world; due to retirement, restructuring and rapid growth in new industries and technologies. Many companies comment on how difficult it is to find experienced electronics professionals, despite paying outstanding salaries. The aim of this 18-month e-learning program is to provide you with core electronics engineering skills so that these opportunities may be accessed, to enhance your career, and to benefit your firm.

Often universities and colleges do a brilliant job of teaching the theoretical topics, but fail to actively engage in the ‘real world’ application of the theory of electronics engineering. Much of the material key to electronic practice and its professional application in the workplace (e.g. data communication systems) is not covered in sufficient detail in university and college curriculums. This advanced diploma is presented by lecturers who are highly experienced engineers from industry, having ‘worked in the trenches’ in the various electronics engineering areas. When doing any program today, a mix of both extensive experience and teaching prowess is essential. All our lecturers have been carefully selected, and are seasoned professionals.

This practical program avoids weighty theory. This is rarely needed in the real world of industry where time is short and immediate results, based on hard-hitting and useful know-how, is a minimum requirement. The topics that will be covered are derived from the acclaimed IDC Technologies’ programs attended by over 500,000 engineers and technicians throughout the world during the past 20 years. And, due to the global nature of electronics engineering today, you will be exposed to international standards.

This program is not intended as a substitute for a 4 or 5 year engineering degree, nor is it aimed at an accomplished and experienced professional electronics engineer who is working at the leading edge of technology in these varied fields. It is, however, intended to be the distillation of the key skills and know-how in practical, state-of-the-art electronics engineering. It should also be noted that learning is not only about attending programs; but also involves practical hands-on work with your peers, mentors, suppliers and clients.

“"If you want to improve career prospects and be trained by excellent trainers with a thorough knowledge of the industry and train at your own pace then I would recommend this program.”

Gary Burrowes, BHPBilliton

“This has been the best study process I have gone through and for advancing the career it is a must. The program content is extremely good and practical as I have baffled my engineers with some of the questions in the assignments making them question the content they actually studied.”

Henk Barnard

To enrol please contact enquiries@eit.edu.au

EIT Program Delivery Methodology

Not all e-learning is the same. See why our methodology is so unique and successful.

Visit:
Accreditation & International Standing for Online Engineering Training

The EIT (and many individual programs) has received recognition, endorsement and/or accreditation as a training provider from authorizing bodies based around the world, including those listed below. Please ask us for specific information for your location.

AUSTRALIA
The Engineering Institute of Technology was declared an educational institution under Section 10 of the copyright Act 1968. The notice was published in accordance with section 10A(4) of the act in the Commonwealth of Australia’s Business Gazette (number B56): “The Engineering Institute of Technology declares that its principal function is the provision of programs of study or training for the following purpose: the continuing education of people engaged in a particular profession or occupation.” – Dated 8th November 2011.

The Engineering Institute of Technology (EIT) is a private Registered Training Organization (RTO) – provider number 51971. EIT is registered with and regulated by the Australian Skills Quality Authority (ASQA). ASQA is the national regulator for Australia’s vocational education and training sector. They regulate programs and training providers to ensure nationally approved quality standards are met.

Many of the programs offered by EIT are nationally accredited and recognized qualifications and are listed on training.gov.au ([TGA]). TGA is the official National Register of Information on Training Packages, Qualifications, Programs, Units of Competency and Registered Training Organizations (RTOs). EIT qualifications accredited to date can be viewed on EIT’s registration page on TGA under the “Scope” tab. You can find EIT on TGA by searching for our provider number – 51971. Programs listed on EIT’s scope have been approved for delivery in all Australian states and territories. Please note that many additional programs are also in the process of accreditation.

The Advanced Diploma of Industrial Electronics Engineering [52490WA] is a nationally accredited and recognized qualification under the AQF. The Australian Qualifications Framework (AQF) is the national policy for regulated qualifications in the Australian education and training system.

Members of Engineers Australia (EA) - are entitled to claim CPD hours for professional learning, short programs, and learning activities at the workplace. CPD hours can be claimed for our programs in most cases, but we would always advise individual members to check with EA regarding specific programs.

NEW ZEALAND
The New Zealand Qualifications Authority recognizes individual qualifications gained overseas on a case-by-case basis. Advanced Diplomas, for example, when registered at the time of award under the Australian Qualification Framework (AQF) are typically recognized as broadly comparable to a National Diploma at level 6 on the NZQF.

SOUTH AFRICA
The Engineering Council of South Africa (ECSA) which aims to promote a high level of education and training of practitioners in the engineering profession, has validated a large number of EIT programs. Members can check details on the ECSA website. South African students who successfully complete an EIT Advanced Diploma and other qualifications have the option to apply for recognition by SAQA, who have determined in the past that an Australian Advanced Diploma program is at Level 6 in the South African National Qualifications Framework (equivalent to Higher Diploma) in South Africa's educational system. However, in most cases formal individual recognition by SAQA is not required as the international validity and accreditation of this credential is very sound.

UNITED STATES
IEEE is the world's largest professional association advancing innovation and technological excellence. EIT is an IEEE Continuing Education Provider. IEEE Continuing Education Programs are peer-reviewed by content experts. This peer review guarantees both quality of the technical content of learning materials, as well as adherence to IEEE’s strict criteria for educational excellence. All programs that pass this strict process are entitled to award IEEE Continuing Education Units (CEUs), recognized as the standard of excellence for continuing education programs in IEEE's fields of interest.

The International Society of Automation (ISA) is a leading, global, non-profit organization that sets the standard for automation around the world. ISA develops standards, certifies industry professionals, provides education and training, publishes books and technical articles, and hosts conferences and exhibitions for automation professionals. ISA has reviewed the curricula of the programs offered by EIT as they relate to the instrumentation, control and automation discipline and are enthusiastic about promoting their availability to the automation community.

UNIVERSITY OF KINGS College
Nationally recognised qualifications that have been achieved at EIT can be compared by UK NARIC to the UK framework. UK NARIC is the UK’s national agency responsible for the recognition of qualifications from overseas and provides services for individuals and organizations to compare international qualifications against UK qualification framework levels. UK NARIC is managed by ECColis Ltd (see http://www.eccolis.co.uk/naric/Default.aspx) which administers the service for the UK Government. Graduates of EIT’s Advanced Diploma programs in the UK can be confident that their international qualification has been officially evaluated as comparable to the BTEC/SAQA Higher National Diploma (HND) standard/Foundation Degree Standard. A BTEC Higher National Diploma is at the same level of the National Qualifications Framework as NVQ/SVQ Level 4. Recognition will be at a higher level for graduate programs.

The Institute of Measurement and Control in the United Kingdom is Britain’s foremost professional body for the Automation Industry. An EIT Advanced Diploma is recognized by the Institute of Measurement and Control as contributing to the ‘initial professional development’ required for eventual registration as Chartered or Incorporated Engineers. The Advanced Diploma is also approved by the Institute as providing CPD.

CANADA
EIT is a Participating Partner with the Engineering Institute of Canada (EIC) and EIT programs can be utilised by members to register for Continuing Education Units (CEUs). EIC’s Continuing Education Program is supported by The Canadian Council of Professional Engineers, The Association of Consulting Engineers of Canada, and The Canadian Academy for Engineering. EIC is a member of the International Association for Continuing Education and Training, with headquarters in Washington, DC.

OTHER COUNTRIES
Students who successfully complete an EIT Advanced Diploma and other qualifications may be able to apply for recognition of their qualification within the local (home country) education system. Many countries have a process for “recognition of foreign qualifications” which is utilised by new residents when they have qualifications earned overseas. Although you will be studying from your home country, you will be awarded an Australian qualification from the EIT, so your EIT qualifications may be able to be recognized as a “foreign qualification” if you apply through your local system. If you would like to find out more, please contact your local education authorities because it is not practical for the EIT to know the systems that apply in all countries. However, in many cases formal individual recognition within the home country may not be required because the international validity and accreditation of this credential is very sound.

Members of other engineering organizations may be able to claim credit for professional development and are advised to check with their own organization.

For additional information please see http://www.eit.edu.au/international-standing.
Program Structure
The program is composed of 18 modules. These cover the following seven main threads to provide you with maximum practical coverage in the field of industrial electronics engineering:

- Electrical/Electronic Technology Fundamentals
- Supporting Technologies and Services
- Analog Electronics
- Digital Electronics
- Electronic Communications
- Programming
- Electronic Maintenance and Troubleshooting

The 18 modules will be completed in the following order:

1) Basic Electrical Engineering Overview
2) Understanding Electrical and Electronic Drawings
3) Shielding, EMC/EMI, Noise Reduction and Grounding/Earthing
4) Digital System Fundamentals
5) Industrial Data Communication Systems
6) Power Electronics and Switch Mode Power Supplies (SMPS)
7) Industrial Electronics
8) Technical and Specification Writing
9) Embedded Microcontrollers
10) Programming in C++
11) Uninterrupted Power Supplies (UPS)
12) Process Control
13) Digital Signal Processing (DSP)
14) Data Acquisition Systems (DAS)
15) Programmable Logic Controllers (PLCs)
16) Troubleshooting Industrial Electronics Components and Circuits
17) Printed Circuit Board Design
18) Industrial Wireless

For detailed information on the content and breakdown of modules, see pages 10 to 27

Presentation Format
The program features real-world applications and uses a multi-pronged approach involving interactive on-line webinars, simulation software and self-study assignments with a mentor on call.

The program consists of 72 topics delivered over a period of 18 months. Presentations and group discussions will be conducted using a live, interactive software system. For each topic you will have an initial reading assignment [which will be delivered to you in electronic format in advance of the online presentations]. There will be coursework or problems to be submitted and in some cases there will be practical exercises, using simulation software and remote labs that you can easily do from your home or office.

You will have ongoing support from the lecturers via phone, fax and e-mail.

Live Webinars
During the program you will participate in 72 live interactive sessions with the lecturers and other participants from around the world. Each webinar will last approximately 60 to 90 minutes, and we take student availability into consideration wherever possible before scheduling webinar times. Contact us for details of webinar session scheduling. All you need to participate is an adequate Internet connection, speakers and a microphone. The software package and setup details will be sent to you prior to the program.

Prior Learning Recognition and Exemptions
The EIT can give you full or partial credit for modules where you can demonstrate substantial prior experience or educational background. An assessment fee may apply. If you wish to find out more please ask us for your copy of the policy for recognition of prior learning.

Time Commitment for the Program
You will need to spend an estimated 6-10 hours per week. This includes the reading of the material prior to your attendance at each hour webinar [45 minutes with 15 minutes for discussion] and the time needed to complete assignments for submission. This time would be required to ensure the material is covered adequately and sufficient knowledge is gained to provide sound, enduring and immediately useful skills in engineering. The EIT operates almost all year long, so your studies will continue most weeks of the year to enable you to achieve the qualification in an accelerated time period when compared to a traditional semester-based system.

Who Should Attend
- Electrical and Electronics Technicians
- Field Technicians
- Electricians
- Plant Operators
- Instrument and Process Control Technicians
- Project Engineers and Managers
- Design Engineers
- Instrumentation Engineers
- Maintenance Engineers and Supervisors
- Energy Management Consultants
- Automation and Process Engineers
- Instrument Fitters
- Consulting Engineers
- Production Managers
- Chemical and Mechanical Engineers

In fact, anyone who wants to gain solid knowledge of the key elements of electronics engineering in order to improve work skills and to create further job prospects. Even individuals who are highly experienced in electronics engineering may find it useful to attend to gain key, up to date perspectives.
Practical Exercises, Remote Labs and Assignments

You will participate in practical exercises using a combination of remote laboratories and simulation software, to ensure you get the requisite hands-on experience. This will give you a solid practical exposure to the key principles covered in the program and ensure you are able to put theory into practice. As research shows, no matter how gifted and experienced an lecturer (and we believe ours are some of the best worldwide), no one learns from an lecturer only presenting program materials to them in a lecture format. It is only by the additional activities of hands-on exercises using simulation software, remote laboratories, practically based assignments and interactive discussion groups with both your peers and the lecturer that you are able to internalise this knowledge, “take ownership of it” and apply it successfully to the real world. Traditional distance learning presents challenges in achieving these goals but we believe today with the modern e-learning technologies available combined with outstanding lecturers that we can give you an equivalent or indeed even better experience than on a traditional university campus. You should note that there is some degree of overlap between the practical sessions and the different Modules to reinforce the concepts and to look at the issues from different perspectives. Practical sessions may be added, deleted or modified by the lecturers to ensure the best outcome for students.

Benefits of Live E-learning

- Attend lessons in a live, virtual classroom with your lecturers and fellow students
- Upgrade your skills and refresh your knowledge without having to take valuable time away from work
- Receive information and materials in small, easy to digest sections
- Learn from almost anywhere - all you need is an Internet connection
- Have constant support from your program lecturers and coordinator for the duration of the program
- Interact and network with participants from around the globe and gain valuable insight into international practice
- Learn from international industry experts
- Live interactive webinars, not just a 'book on the web'
- Receive an EIT Advanced Diploma of Industrial Electronics Engineering

About the Engineering Institute of Technology (EIT)

The key objective of the Engineering Institute of Technology (EIT) is to provide an outstanding practical engineering and technology education; at Diploma level and beyond. The finest engineering lecturers and lecturers, with extensive real engineering experience in industry, are employed from around the world. The learning is enhanced through live, two-way, online [e-learning] technologies. The EIT offers certificates and diplomas in a growing array of engineering fields. Many (perhaps, most) engineering faculties in universities and colleges experience a significant challenge delivering the program-work affordably and with excellence. The EIT achieves this using online based education: economical class sizes are attainable, international experts are engaged to instruct and remote laboratories and simulation software are employed.

The EIT is a sister company of the well known and reputable engineering training organisation, IDC Technologies. IDC has been operating for over 20 years, from offices throughout the world, delivering practical short programs to well over 500,000 engineers and technicians.

Why EIT?

- Our lecturers are selected and recruited from amongst the top engineers/lecturers in their field - worldwide. These presenters are highly skilled at presenting challenging concepts and ideas to students of varying levels and abilities.
- As shown in the detailed program prospectus, the programs are aimed at practising professionals giving hard-hitting practical know-how relevant to today’s market and is aimed at people working in industry. We design and select Case Studies and practical exercises in the program based upon real-world business requirements.
- Feedback from the tens of thousands of students we have trained over many years has allowed EIT a unique understanding of real world business requirements and we have tailored the program accordingly.
- We have experience in training over 500,000 engineers and technicians throughout the world and have built up a library of outstanding reference materials which focus on what engineers and technicians need in their work today in industry and mining. The value of these references is considerable and they are a great asset to industry professionals. These reference materials are included in the cost of the program.
- The program content is challenging and designed for engineers and technicians already working in industry. We assume a general understanding of the demands of the workplace. A student without practical experience would be unsuited to the program.

Program Fees

Your program fees include weekly webinars with leading engineering and technical experts, 30 technical eBooks, all program materials, software and postage, plus grading and support from the program coordinators and lecturers. We provide payment options and can accept fees in a variety of currencies. Please contact your advisor for fees in an appropriate currency for your location.

To enrol please contact enquiries@eit.edu.au
Comprehensive e-Books and Associated Documentation

You will receive 30 of our up-to-date technical, searchable, e-Books to add to your library. Together these texts contain over 8000 pages of valuable know-how distilled from years of experience in presenting these programs throughout the world.

1) Basic Electrical Engineering Fundamentals
2) Understanding Electrical Drawings Schematics
3) Best Practice in Process, Electrical and Instrumentation Drawings and Documentation
4) Shielding, EMC/EMI, Noise Reduction and Grounding/earthing
5) Digital System Fundamentals
6) Best Practice in industrial Data Communications Systems
7) Power Electronics and Switch Mode Power Supplies
8) Fundamentals of Industrial Electronics
9) Practical Specification and Technical Writing
10) Embedded Microcontrollers
11) UPS and Battery Power Supplies
12) Practical Process Control
13) Digital Signal Processing
14) Data Acquisition Troubleshooting and Systems
15) Programmable Logic Controllers for Automation and Process Control
16) Best Practice in Industrial Data Communications
17) Practical Troubleshooting of Electronic Circuits for Engineers and Technicians
18) Installation, Calibration and Maintenance of Electronic Instruments
19) Practical Electrical Safety Techniques for Industry
20) Electrical Maintenance for Engineers and Technicians
21) Understanding Electrical Engineering and Safety for non-electricians
22) Practical Advanced Process Control for Engineers and Technicians
23) Best Practice in Process, Electrical & Instrumentation Drawings and Documentation
24) Practical Troubleshooting of Data Acquisition & SCADA Systems
25) Practical Power System Protection for Engineers and Technicians
26) Practical Hazardous Areas for Engineers and Technicians
27) Practical Troubleshooting of Instrumentation, Electrical and Process Control
28) Practical Project Management for Engineers and Technicians
29) Programmable Logic Controllers (PLCs) and SCADA Systems
30) Practical Fundamentals of Telecommunications and Wireless Communications

Please Note: Students who choose to pay upfront will receive all 30 e-Books in advance. If you opt to pay by installments you will receive e-Books periodically throughout the program.

Contact us for pricing details.

For more information or to enrol, please contact enquiries@eit.edu.au

Entrance Requirements

This Engineering Institute of Technology advanced diploma is an accelerated, practical, work-oriented program. It is designed for engineers and technicians who have some background in the field. This includes those who have technical or 'trade' qualifications who want to move to the next career step, those with substantial relevant work experience who need to formalise and enhance their achievements, and those with higher level qualifications in a related field who wish to develop specialist knowledge. Practical work experience in related areas of engineering would help enormously. It would not be suitable for a student with no relevant work experience. We will review your enrolment application and may recommend pre-program studies if required.

Advanced Diploma Preparation Program

If you are unsure if you have a strong enough grasp of the fundamental knowledge required for this program, or you simply want to refresh your skills and experience e-learning in a shorter program, we recommend that you consider the EIT's engineering studies preparation program. This intensive 4-month program covers the fundamentals of engineering maths, physics and chemistry. Please ask your advisor for the brochure. If you don't currently have an existing qualification and/or experience, please contact us for advice. Most important, however, is a determination to persist and complete this program.

On completion of this program, 50% of the program fees can be used as a credit towards your fee for an EIT Advanced Diploma program.

Hardware and Software Requirements

All you need in order to join the webinars once registered for the program is an adequate internet connection, PC, speakers and a microphone. The software package and setup details will be sent to you prior to the program.

We are Flexible With Your Commitments

We recognise that personal circumstances can make it difficult to complete the program in the time available. We will be flexible about the time you require to complete the program. You can "pause and restart" by joining a subsequent intake (a rejoining fee may apply). We will allow up to 3 years from your original start date to complete the program.

You can withdraw from the program at any time and receive a Statement of Attainment for the topics you have completed. However, completion of all 72 topics will earn you the EIT Advanced Diploma of Industrial Electronics Engineering.

Who Should Attend

• Electrical and Electronics Technicians
• Field Technicians
• Electricians
• Plant Operators
• Instrument and Process Control Technicians
• Project Engineers and Managers
• Design Engineers
• Instrumentation Engineers

• Maintenance Engineers and Supervisors
• Energy Management Consultants
• Automation and Process Engineers
• Instrument Fitters
• Consulting Engineers
• Production Managers
• Chemical and Mechanical Engineers

In fact, anyone who wants to gain solid knowledge of the key elements of electronics engineering in order to improve work skills and to create further job prospects. Even individuals who are highly experienced in electronics engineering may find it useful to attend to gain key, up to date perspectives.
What Our Students Have to Say

QUOTES FROM PAST STUDENTS

on the EIT SURVEY

ON E-LEARNING

to the following question:

What made you choose an EIT program(s)?

“Believed to be good quality based on previous training programs I have done in person.”  BHP Billiton, South Africa

“It was referred to me by a colleague and I have attended seminars run by IDC before. The program that I am currently enrolled in had all the outcomes I was looking for to further my career.”  Rio Tinto

“The program content was relevant to my work environment and practical.”  Alcoa

“I have done a few IDC programs in the past and found them to be very good and delivered by people with practical knowledge of the subjects.”  Kalgold

“It provides good online program delivery including its quality support structures.”  OneSteel

“Program interest and content.”  ABB, Australia

“The fact the I could do it online and it was in line with furthering my knowledge for work.”  CAED, Australia

“It ticked all the boxes ... quality, suitability, depth, length.”  Powerco, New Zealand

“Better choice of topic.”  Rockwell RA

“Program was visible and relevant.”  Schneider Electric, UK

“Convenience.”  Rio Tinto

“To be perfectly honest with the small amount of research on various programs I did the programs are generally the most relevant to my area of work. That’s not to say they are perfect but they seem to be superior to others readily available in this part of the world.”  WEL Networks, New Zealand

“Program content seems practical and applicable. I already have a BSc where the focus is on the theory.”  BHP Billiton, South Africa

“Industry recognition and recommendation by colleagues.”  Rio Tinto

“Seemed the most convenient option, and it was!”  CPIT, New Zealand

“Program content ease of study option.”  Nestle, South Africa

“The content of the program made up my mind.”  Transportadora de gas del Norte, Argentina

“Their programs are standard and program material as well as lecture are okay.”  Shell, UK

“Its international recognition with body endorsing certification. Easy to attend lessons after work hours. Easy way of program payment.”  Kinyara Sugar Ltd, Uganda

“The most practical and technical offerings by the most qualified lecturers for distance learning.”  Encana Natural Gas

“On line references, price, and various time frames available to sit in on the class. Also, one more important item was being able to converse with the lecturer and class instead of working totally on my own.”  Mitchell Technical Institute

“Program content. Accreditation of the training institution. Cost.”  MODEC

“Offer the correct program, timing and affordable cost.”  Folec, Brunei

“Possibly the most recognised online institution within my industry.”  DRA, South Africa

“Good reputation, had attended good full-time programs previously.”  Worley Parsons

“Program facilitator CV, ...reputation, e-learning flexibility.”  SMK, New Zealand

“Content tends to practical and targeted.”  MIPAC, Australia

“Non-vendor specific training and lower program costs with online training capabilities.”  Worley Parsons

“The content of the program and the way the program was broken down were the key factors.”  GEA Group

“I can do those programs at my own free time which made it more convenient for me.”  Iluka, Australia

“Content was applicable to my job and industry. Taught by industry experts not academics. E-room delivery mode. Accreditation in various nations.”  Sanofi Pasteur, Australia

“Because it is specialist, and so many available programs.”  Kacst, Saudi Arabia

“Covered all my criteria and gave me recognised qualifications on completion.”  Netafim

“I took a previous program, IDC [associated organisation] is professional.”  Cat Group

“I have done other programs with IDC [associated organisation] and was happy with the service provided.”  GHD

“Had completed programs previously. Good content.”  Woodside

“I understood from friends that it is good quality.”  Rio Tinto

“Better choice of topic.”  Rockwell RA

“Program content seems practical and applicable. I already have a BSc where the focus is on the theory.”  BHP Billiton, South Africa

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“Possibly the most recognised online institution within my industry.”  DRA, South Africa
International Expert Speaker Faculty

Your team of professional presenters and facilitators are drawn from experts in their field. They will work closely with you for the duration of the program. Please note: Lecturers are subject to change. Students will be notified in the event new lecturers join the faculty.

PROGRAM ADVISOR

Steve Mackay  
PhD, BSc{Elec.Eng}, BSc{Hons}, MBA, MMR, CP Eng , FIE(Aust)
Dean of Engineering, EIT

Steve has worked in engineering throughout Australia, Europe, Africa and North America for the past 30 years. He has presented numerous industrial automation and industrial data communications programs worldwide to over 18,000 engineers and technicians, and has a particular interest in practical and leading edge aspects of marketing, business and engineering practice. He is a fellow of Engineers Australia and the technical director and founder of the EIT’s sister company, IDC Technologies, a growing engineering training and publishing firm which has been operating from offices throughout the world since 1992. He has also acted as the author or editor of over 30 engineering textbooks sold worldwide. He feels that all engineering businesses need to think globally and keep experimenting with new approaches. He is currently leading a team of two design engineers and four programmers in creating a new video conferencing software package with remote labs which he believes will make a marked impact on engineering training.

PROGRAMME DESIGNER AND PRESENTER

Deon Reyners  
BSc, BSc[Eng](Hons), MBA
Senior Engineer

Deon has had over 25 years experience in automation, data communications [with a focus on industrial applications] and Ethernet TCP/IP networks with specific experience in Systems Engineering, Project Management and software and hardware development. He is currently retained as a consultant to industry in the TCP/IP, industrial Ethernet networking, OPC and the industrial data communications area.

Deon is a practical, hands-on person and an entertaining speaker. He has received excellent reviews from his thousands of program participants in regions ranging from Europe, North America, Africa and Australia. He takes great pride in demystifying difficult concepts and presents them in a simple-to-understand manner. A passionate, enthusiastic and knowledgeable professional engineer you will walk away from this program with a wealth of know-how which you can immediately apply to your work.

PROGRAMME LEADER AND PRESENTER

George Marx  
Pr Eng, B Sc [Eng]
Senior Engineer

With over 25 years experience since earning his electrical engineering degree, Georg commenced in Power System Protection and then migrated to EMC and Power Systems. George’s portfolio of achievements includes EMC design of Power Systems, Switch Mode Power Supplies, UPS and high precision Servo Amplifiers for high reliability military applications. Other projects he has engaged in include: Battery and Inverter Design for industrial systems, such as solar panel applications, vehicle management, specialised computer systems and high current starter for vehicle plants. Video systems for UAV’s and the design of a high resolution IR Camera for industrial and military application.

George has developed and presented several programs for Technikon SA (now UNISA) and has founded an IT company which specialize in Wireless Internet and networks – ICT consultation. When George takes a break from his hectic schedule of electrical engineering design, he enjoys wildlife photography, and outdoor activities in the african bush. An experienced and enthusiastic lecturer and professional engineer, with a wealth of knowledge under his belt, you will gain much from his practical approach and entertaining style.

LECTURER

Terry Cousins  
BSc {Elec Eng}

Terry Cousins was educated at La Salle College in Discovery, and obtained a BSc Electrical Engineering degree from Wits in 1977. He has over 30 years of experience in electrical power and distribution systems in various South African industries including the mining and steel sectors, with national companies such as ISCOR and Chamber of Mines Research.

He is currently a director of TLC Engineering Solutions who develops a wide range of instrumentation and measurement systems forindustry. He also presents numerous programs on electrical power distribution and power quality, both in South Africa and abroad.

Terry is a Senior Member of the SAIEE, and a Member of the IEEE (USA) and has also has served on the South African National Standards committee for power quality instruments (SANS 1816). Terry is an accredited professional with the Green Building Council of Australia, and has BComm and MBL degrees from UNISA.
International Expert Speaker Faculty

LECTURER

Brian Hobby  BE [Electrical and Electronic] Auckland University

Brian has 20+ years of engineering experience. He thinks in systems and the connections between them as a result of his time as a Naval Weapons Electrical Engineering Officer.

As a design, commissioning and project engineer with Rio Tinto Alcan he oversaw the first application of devicenet in an aluminium smelting environment and assisted with piloting fully automated anode changing.

More recently he has been involved with collecting data from process using the OSIsoft historian and using their toolset for analysis. His experience with networking goes back to becoming the accidental sysadmin for a Novell Netware system in the early 1990's and has been a part of his roles ever since.

Currently he works for Griffith University as a Technical Lead/Project Manager where he is assisting in collecting and analysing data in support of their sustainability initiatives.

LECTURER

John Piperides

John is a professional electrical engineer with over 25 years experience in industrial maintenance, production, management, sales and improvement. He has held management positions in several manufacturing and sales companies. His diverse responsibilities have included contract negotiation, authoring and responsibility of departmental budgets, daily management of over 20 reports, practice of cGMP, auditing in a pharmaceutical plant, and system administration and programming of diverse IT and embedded systems. He has been directly involved with industries including building management, pest control, mining, power utilities, food, pharmaceutical, steel, building products, sugar, paper and pulp, rail and airports.

John has completed many years of further education including developing, writing and delivering many work based programs and seminars. He has spent 10 years as a part time teacher at TAFE in electrical engineering, and 15 years delivering structured programs in thermography, power quality, instrument safety, motor drive theory, PLC, SCADA, and pest inspection.

LECTURER

Mark Shuttleworth  GradDipCommSys, BA, ACEEng, CIVTAE

Mark has over 25 years experience in electronics and communications engineering. Mark began his career gaining broad and extensive industrial experience in various electronic communication companies and departments such as GPT Telecommunications, Unilab Telecommunications and Stanilite electronics, where he has worked on the development, installation and commissioning of cellular/trunk UHF radio and two way radio HF, VHF and UHF systems for the defence, emergency services and commercial clients. Mark then started a training career as an engineering lecturer in TAFE teaching fundamental electrical units to more advanced units in wireless communications, industrial data communications and engineering mathematics. He has also designed and built RF electronic devices for training purposes and written many training manuals for both students and commercial clients.

Mark is now the principal lecturer of engineering at Central Institute of Technology in Western Australia and has also worked as a consultant communication systems engineer for the past few years working on various small to large projects. One large project that Mark worked on was as an independent technical consultant with the Western Australian Police which included consulting with the police radio division and Motorola on the installation and commissioning procedures of a multi-million dollar digital trunk radio system.
Module 1: Basic Electrical Engineering Overview

Duration: 3 WEEKS

What you will learn:

- The development and growth of electrical engineering
- Electrical conductors, insulators, semi and superconductors
- Electricity and magnetism
- Power distribution equipment
- Power utilisation equipment
- Power quality
- Electrical safety

Overview

This module gives an overview of generic electrical engineering principles and the equipment used for generation, transmission, transformation, distribution and utilisation of electrical energy. It also covers the issues involved in operating electrical equipment and machinery such as electric power quality and safety. It is intended to serve as an introduction to the modules which follow in this program, to enable participants to develop an appreciation of the principles involved, and to facilitate understanding of the ensuing modules.

This module has an ‘electrical’ (heavy current) bias as opposed to the ‘electronic’ (light current) orientation of the program as a whole. This has been done intentionally in order to give students an understanding of the broader environment in which electronics systems operate. Often the dividing line between ‘heavy current’ and ‘light current’ becomes quite blurred. For example, the high voltage switchgear on a diesel-electric locomotive could be controlled by a microprocessor.

THE PROGRAM

Due to space limitations we have summarised this module’s outline. For more detail please contact us.

Topic 1.1
A Brief Historical Perspective About Electricity
Electrical Insulators, Conductors, Semiconductors and Superconductors
Electromagnetism
Electrical Measurements and Applications in Industry

Topic 1.2
Electrical Power Generation, Transmission, Distribution and Utilisation
Electrical Lighting and Illumination
Engineering Fundamentals

Topic 1.3
Electrical Heating in Industry
Power Electronics and its Applications in Electrical Engineering
Embedded Power Generation in Industry
Module 2: Understanding Electrical and Electronic Drawings

Duration: 3 WEEKS

You will learn how to:

- Read drawings for electrical/electronic schematic diagrams
- Use symbols to represent electrical/electronic devices schematically
- Plan and execute schematic drawings using universally understood conventions
- Make efficient use of CAD packages and their extensions
- Manage a drawing office and organise suitable workflow procedures
- Carry out version control, storage and retrieval of CAD drawings

Overview

Drawings are used to communicate and share information between different teams of engineers; the design engineer who conceptualises equipment or systems, the production engineer who plans the steps in manufacturing the required components and subsystems, the assembly engineer who puts the components together, the testing engineer who tests the complete system, the installation engineer who installs the system or equipment and the maintenance engineer who is responsible for its upkeep. To all these individuals, with diverse backgrounds and expertise, a drawing should convey precise and identical information. This calls for standardised methodologies, conventions and approaches in preparing drawings. This module covers all of these aspects with respect to engineering drawings in general and electrical drawings in particular. Various types of electrical drawings and their application, the steps in planning a drawing, selection of drawing size and scale, use of standardised symbols etc. are described in detail with commonly used examples from industry practice.

THE PROGRAM

Due to space limitations we have summarised this module's outline. For more detail please contact us.

Topic 2.1
Introduction to Engineering Drawings
Components of a Drawing, Drawing Sizes and Scales
Symbols Used in Electro Technology and Governing Standards

Topic 2.2
Single-Line and 3-Line Diagrams
Schematic Diagrams
Logic Diagrams
Cabling and Wiring Drawings
Layout Drawings

Topic 2.3
Advances Arising from Computer Aided Drafting (CAD)
Management of Drawings
**Module 3: Shielding, EMC/EMI, Noise Reduction and Grounding/earthing**

**Duration:** 2 WEEKS

**You will learn how to:**
- Ground/earth a circuit effectively
- Diagnose noise problems
- Identify and fix EMI/EMC problems
- Effectively design to filter at MHz frequencies
- Understand the four noise coupling mechanisms and how to minimise them
- Understand the function of the signal ground/earth versus the signal return
- Ground/earth a cable shield correctly
- Reduce DC power bus noise
- Select cables appropriately
- Know when to shield and when to filter
- Effectively ground/earth mixed analog and digital signals
- Minimise pulse ringing and rounding problems
- Reduce ground/earth loop noise
- Reduce emission and susceptibility problems
- Create a checklist of items to ensure CE approval

**Overview**

The aim of this module is to help you identify, design, prevent and fix common EMI/EMC problems with a focus on grounding/earthing and shielding techniques. Learning how to fix grounding/earthing and shielding problems ‘on the job’ can be very expensive and frustrating. Although it must be noted that most of the principles involved are simple, this module will give you the tools to approach earthing and shielding issues in a logical and systematic way. It focuses on the issues of interest if you are involved in the design, operation or maintenance of analog or digital systems involving sensors, data acquisition, process control, cables, signal processing, Programmable Logic Controllers, power distribution and high speed logic.

**THE PROGRAM**

Due to space limitations we have summarised this module’s outline. For more detail please contact us.

**Topic 3.1**
Introduction
EM Principles
Shielding
Grounding/Earthing

**Topic 3.2**
Cables and Connectors
Circuits and Components
Protection and Filtering
Engineering Measurements
Power Supplies
EMC Engineering Management
Module 4: Digital System Fundamentals

Duration: 6 WEEKS

You will learn how to:

- Work with the terminology and number systems underpinning digital system designs
- Design and build circuits with Small Scale Integration (SSI) functions such as AND and OR gates
- Design and build circuits with Medium Scale Integration (MSI) functions such as counters and shift registers
- Describe the basics of Microprocessors and related memory devices
- Use software design and simulation tools to facilitate digital system design

Overview

This module covers the design and operation of digital systems. It deals with all the technologies involved - from simple combinational logic based on gates, thru flip-flops, counters, decoders and shift registers, to microprocessors. In addition, it introduces the use of programmable devices and software tools to augment the older hard-wired approach in implementing logic functions.

THE PROGRAM

Due to space limitations we have summarised this module’s outline. For more detail please contact us.

Topic 4.1
Introductory Digital Concepts
Number Systems, Operations, and Codes

Topic 4.2
Logic Gates
Boolean Algebra and Logic Simplification

Topic 4.3
Combinational Logic
Functions of Combinational Logic

Topic 4.4
Flip-Flops and Related Devices
Counters

Topic 4.5
Shift Registers
Memory and Storage

Topic 4.6
Introduction to Microprocessors, Computers, and Buses
Integrated Circuit Technologies
Module 5: Industrial Data Communications Systems

Duration: 6 WEEKS

What you will learn:

- The basics of serial data communications systems (e.g. RS-485)
- The basics of Ethernet
- The basics of the TCP/IP protocol suite
- The basics of industrial protocols such as Modbus
- The differences and similarities between the popular Fieldbuses
- How to integrate different industrial communications protocols and standards into a complete working system

Overview

This module will outline best practice in designing, installing, commissioning and troubleshooting industrial data communications systems. In any given plant, factory or installation there is a myriad of different industrial communications standards used and the key to successful implementation is the degree to which the entire system integrates. With so many different standards on the market today the debate is not about what is the system to use, but rather about selecting the most appropriate technologies and standards for a given application and then ensuring that best practice is followed in designing, installing and commissioning the data communications links to ensure they run fault-free.

The industrial data communications systems in your plant underpin your entire operation. It is critical that you apply best practice in designing, installing and fixing any problems that may occur. The important point to make is that with today’s wide range of protocols available, you only need to know how to select, install and maintain them in the most-cost effective manner for your plant or factory. A knowledge of the minute details of the protocols is not necessary.

THE PROGRAM

Topic 5.1
Introduction
- Data communication basics
- OSI model

Cabling Infrastructure
- Noise, grounding/earthing and shielding
- Protection against dust and moisture
- Copper cable
- Optic fiber
- Connectors
- Cable termination
- Transient protection

Topic 5.2
Physical Layer Standards
- RS-232
- RS-422
- RS-485
- 4-20 mA
- Converters

Topic 5.3
Ethernet
- Basic concepts
- 10 Mbps, 100 Mbps and Gigabit variants
- CSMA/CD vs. full duplex
- Packet structure
- Devices (hubs, bridges, switches, routers, gateways)

Topic 5.4
Industrial Protocols
- TCP/IP
- Modbus Serial
- Modbus TCP
- DNP3

Topic 5.5
First and Second Generation Fieldbuses
- The Fieldbus concept
- Fieldbus standards
- Modbus Plus
- Data Highway Plus
- HART
- DeviceNet
- Profinet
- Foundation Fieldbus H1

Topic 5.6
Third Generation (Ethernet based) Fieldbuses
- Ethernet/IP
- Profinet
- Foundation Fieldbus HSE
- EtherCAT
Module 6: Power Electronics and Switch Mode Power Supplies (SMPS)

Duration: 4 WEEKS

You will learn how to:

- Describe the basic construction of a series regulated (linear) power supply
- Describe the basic construction of an SMPS
- Use various performance calculations related to power supplies
- Design a simple series regulated power supply
- Design a simple SMPS
- Troubleshoot power supplies

Overview

Every electronic device needs a source of power. In some cases batteries may be acceptable, but if a more sustainable supply is required, a power supply of some description is required. This may vary from a simple, inexpensive unregulated supply, to a more sophisticated linear or switched-mode power supply. This program will explain the differences as well as the advantages/disadvantages of the different types, and equip the student to either design a simple power supply, or troubleshoot an existing one.

THE PROGRAM

Topic 6.1
Basic Power Supply Concepts
- Basic principles of PSU circuits
- Power supply specifications
- Linear and SMPS comparison
- SMPS block diagram

Topologies
- Non-isolated topologies
- Isolated topologies
- Comparison of topologies
- Choice of topology based on power supply specifications

Integrated Circuit Pulse Width Modulation Controllers
- PWM controller review
- UC3825 block diagram
- The speed critical path
- High speed complementary blocks
- Glue or remaining blocks

Topic 6.2
Input Section
- Component selection and design criteria - Input rectifiers; Input filter capacitors; AC or DC input line filters for RFI suppression
- Input protective devices - Inrush current; Input transient voltage protection

Power Transistor
- Transistor selection
- Gate/base drive considerations and circuits
- Design considerations for safe operating of transistor - transistor losses; ripple current; de-rating factors
- Switch protection circuits

Topic 6.3
High-frequency Transformer
- Basic transformer theory
- Core material and geometry selection
- Design of a power transformer for a PWM push-pull converter.
- Losses and temperature rise
- Winding techniques

Output Section
- Output rectification and filtering
- Power rectifier characteristics
- Output power inductor design
- Output filter capacitor design

Stability in SMPS
- Transfer functions
- Criteria for stability
- Control to output gain
- Design compensation network
- Loop stability measurements

Topic 6.4
EMI-RFI Considerations
- Noise specifications
- RFI sources in SMPS
- Filters for RFI suppression

EMI-RFI Considerations
- Construction requirements - spacing requirements; Dielectric test; insulation resistance
- Transformer construction - insulation; Dielectric strength; insulation resistance; temperature rating

Heatsinking
- The thermal equation
- Selecting a heatsink
- Custom heatsink
Module 7: Industrial Electronics

Duration: 4 WEEKS

You will learn how to:

- Demonstrate the construction and operation of common electronic components
- Utilise common electronic terminology
- Effectively apply the principles of analog meters, digital meters and oscilloscopes
- Identify electronic component symbols
- Identify components and read their values

Overview

This module covers the basics and application of discrete components such as diodes and transistors. In addition, students will be introduced to simulation software in order to design and test circuits before actually constructing them.

THE PROGRAM

Topic 7.1
Basic Concepts
- Atomic structure
- Insulators, conductors and semiconductors
- Current, voltage, resistance, power
- Units and abbreviations
- Direct and alternating current

Circuit Laws
- Ohm’s Law
- Kirchhoff’s Voltage Law
- Kirchhoff’s Current Law

Topic 7.2
Discrete Components
- Resistors, inductors and capacitors
- Transformers and bridge rectifiers
- P/N diodes
- Bipolar junction transistors (PNP/NPN)
- JFETs and MOSFETs
-SCRs, DIACs and TRIACs
- LEDs
- Surge arrestors [Zener diodes, gas diodes, MOVs]

Amplifiers
- Small signal amplifiers
- Power amplifiers
- Amplifier frequency response
- Amplifier applications

Topic 7.3
Operational Amplifiers
- Op-amp parameters
- Negative and positive feedback
- Op-amp frequency response, stability and compensation
- Power supplies

Operational Amplifier Applications
- Voltage followers
- Amplifiers with gain
- Integrators
- Low-pass filters

Topic 7.4
Using Test Equipment
- Current measurement
- Voltage measurement
- Resistance measurement
- Analog meters
- Digital meters
- Oscilloscopes

Simulation Software
- SwitcherCAD
Module 8: Technical and Specification Writing

Duration: 4 WEEKS

You will learn how to:

- Systematically design and write accurate and comprehensive technical specifications
- Write realistic specifications, thereby improving project management and performance
- Write clear and concise formal reports, equipment manuals and other technical documentation
- Develop effective communication with technical as well as non-technical staff at all levels [from top management within the organisation to the end user in the home environment]
- Collect, organise, analyse and evaluate information
- Translate technical documents into captivating oral presentations

Overview

Considerable effort and time is required to research and prepare technical documents, especially technical specifications. This program is designed to give you step-by-step guidance to writing these documents in a professional manner, working within a cost and time framework. The program will demonstrate techniques to establishing more effective communication between technical and non-technical staff and foster skills relating to problem identification and solutions, plus enhancing skills in information seeking, research and organising collected data in a non-conflicting, unambiguous manner.

THE PROGRAM

Topic 8.1
Introduction to Technical Writing
- Fundamentals of technical writing
Development Process
- Writing objective
- Reader identification
- Research
- Report organisation
- Development methods
- Conclusion/recommendations
Report Outline
- Mind mapping
- Outline formats
- Rough draft and revision
- Grammar, language, expressions and units of measures
Appearance
- White space
- Headings/sub-headings
- Color
- Illustrations
- Graphic material

Topic 8.2
Formats of Technical Writing
- Formal report
- Technical memo report
- Technical proposal
- Equipment/maintenance manual
- Journal article
Types of Technical Reports
- Periodic
- Progress
- Research
- Recommendation
- Field

Compiling a Report
- Establish a framework
- Terms of Reference

Structure of a Technical Report
- Main sections
- Elements of technical writing
- Other sections

Topic 8.3
Specification Writing
- Fundamentals of specification writing
- Preparing the specification [customer, market, risk, product, scope]
- Specification database [basic specification information, organising input from different specialists and sources]

Structure of Technical Specification
- Master format [correct numbering and titling]
- Section format
  - Section 1: administration/procedures/maintenance
  - Section 2: product information
  - Section 3: execution of the specification

Topic 8.4
Verbal Presentation of Reports
- Preparing presentation with report as guideline
- Formulating the central message
- Arranging ideas, facts and supportive arguments logically
- Mind mapping technique
- Positive impact [appearance, gestures, eye contact, body language, style of speaking]
- Slides
- Other visual aids
- Maximising delivery [fielding questions, managing answers, handling difficult situations, short talk guidelines]
Module 9: Embedded Microcontrollers

Duration: 4 WEEKS

You will learn how to:

- Outline the software development environment for Microchip PIC embedded controllers
- Embed a series 16 PIC
- Develop assembly language programs for the PIC
- Develop Basic programs for the PIC
- Interface the PIC with external (Input/Output) devices such as switches, LCD displays and stepper motors

Overview

There are many uses for embedded microcontrollers in the workplace; even in and around the house in applications such as light controllers, intruder detectors and irrigation controllers. Unfortunately that requires a practical understanding of the technology, and a modicum of assembler or basic programming skills. This module will bridge the gap.

THE PROGRAM

**Topic 9.1**
The PIC Microcontroller Family
- 12 bit instruction word
- 14 bit instruction word
- 16 bit instruction word
- PIC microcontroller internal structure

**PIC 16F84A**
- PIC 16 series family
- Architectural overview
- Review of memory technologies
- Memory
- Timing issues
- Power-up and reset
- Ports
- Clock oscillator
- Power supply

**Topic 9.2**
Assembler Programming: Basics
- Assembler basics
- Development environment
- Simulation
- Downloading programs to the 16F84A
- 16F84A instruction set
- Subroutines

**Topic 9.3**
Assembler Programming: Intermediate Operations
- Interrupts
- EEPROM
- A to D conversion
- Comparator
- Switch scanning
- Keypad scanning

**Topic 9.4**
PicBasic Programming
- PicBasic language
- LCD interface and commands
- Interrupts
- Controlling stepper motors
- Controlling servomotors
Module 10: Programming in C++

Duration: 4 WEEKS

You will learn how to:
- Set up a C++ development environment on your own computer
- Write simple programs in C++
- Compile, run and debug your own C++ programs
- Interpret existing C++ source code

Overview

C++ is a general-purpose programming language. It was developed by Bjarne Stroustrup at Bell Labs (around 1979) as an enhancement to the C programming language. It is arguably one of the most popular programming languages ever created, and is widely used in the software industry. Applications include systems software, application software, device drivers, embedded software, high-performance server and client applications, and entertainment software such as video games. Several groups provide both free and proprietary C++ compiler software, including the GNU Project, Microsoft, Intel and Borland.

This module is aimed at providing newcomers to the programming world a proper grounding/earthing in C++ and its development tools.

THE PROGRAM

Topic 10.1
C++ Programming Part 1
- Introduction to C++
- IF statements
- Loops in C++
- Functions
- Switch case
- Pointers
- Structures

Topic 10.2
C++ Programming Part 2
- Arrays
- Strings
- File I/O
- Typecasting
- Classes
- Inline functions
- Command line arguments

Topic 10.3
C++ Programming Part 3
- Linked lists
- Recursion
- Variable argument lists
- Binary trees
- Inheritance
- Initialisation lists
- C++ Class Design

Topic 10.4
C++ Programming Part 4
- Enumerated types
- Formatted output in C++
- Generating random numbers
- Using Modulus
- Templates in C++
- Templated functions
- The C Preprocessor
Module 11: Uninterrupted Power Supplies (UPSs)

What you will learn:
- Power quality issues and the role of UPS in power quality improvements
- Types of UPS systems and comparison of their features and relative strengths
- Power electronic components in static UPS systems
- Static UPS systems, the types normally used and applications with special emphasis on computer installations
- Static UPS configurations and grounding/earthing of UPS output
- Basic theory of batteries, types, construction and chemical reactions
- Charging and discharging of batteries, charging equipment and their basic schemes
- Sizing of batteries for AC and DC UPS applications
- Salient points about installation, maintenance, testing and disposal of batteries
- Safety issues for personnel working on battery installations

Overview
In industrial applications, there are always certain critical electrically operated loads of which the stoppage may have widespread repercussions on the operation of other equipment and on the production process itself. In some cases, even equipment damage can result, or the safety of plant personnel can be compromised. Such loads must receive power supply from sources that provide extremely high reliability. Use of UPS systems is one of the ways of supplying reliable electric power to critical loads. We will mainly deal with static UPS systems in this module, though other options will also be discussed in some detail. Static UPS systems are deployed to ensure electric supply under conditions of failure of normal power supplies, and are mainly powered by storage batteries that provide the required backup power. We will also discuss the subject of storage batteries in detail.

THE PROGRAM

Topic 11.1 Overview
- Power quality improvement
- Planning for reliability
- UPS system options
- Battery performance and selection
- Maintenance and disposal of batteries

Power Quality
- What is power quality?
- Power quality indicators
- Power quality problems-effects and mitigation

Continuity of Power and UPS Systems
- Planning for reliability
- Redundancy and automation
- Uninterrupted power supply systems
- Rotary UPS systems
- Advanced rotary UPS systems
- Hybrid UPS system

Topic 11.2 Refresher on Semiconductors, Rectifiers and Inverters
- Transistors
- Thyristors
- MOSFETS and IGBTs
- Rectifiers [converters]
- Ripple and ripple control
- Inverters

Static UPS Systems
- Types of static UPS systems
- UPS metering, indications, alarms and protection
- UPS applications to computer loads
- UPS configurations and ratings for computer installations
- Redundant UPS configuration
- Grounding/earthing of UPS derived supplies

Topic 11.3 Battery Basics
- Construction of secondary cells
- Applications of secondary batteries
- Chemical reactions in batteries

- Salient features of lead-acid batteries
- Salient features of nickel-cadmium batteries
- Main types of lead-acid batteries

Charging and Discharging of Batteries
- Float charging
- Boost charging
- Overcharging and undercharging
- Discharging of batteries
- Battery charging equipment
- Nickel cadmium batteries

Selection and Sizing of Batteries
- Sizing procedure
- Calculating the number of cells
- Duty cycle
- Computing the battery capacity based on duty cycle
- Correction factors
- UPS battery sizing

Topic 11.4 Installation of Batteries
- Standards
- Requirements for safety during installation and operation
- Storage and pre-installation planning
- Installation of battery racks and batteries
- Installing flame arrestors and labels
- Making and checking integrity of electrical connections

Battery Failures
- Major causes
- Sulphation and hydration
- Failure modes

Maintenance of UPS Systems and Batteries
- Safety precautions
- Maintenance and inspection activities
- Capacity testing for assessing residual battery life
- Test equipment for capacity/integrity testing
- Failure prediction
- Conductance testing
- Plate polarisation measurements
Module 12: Process Control

Duration: 4 WEEKS

You will learn how to:

- Explain the fundamentals of process control and new techniques
- Tune PID control loops
- Correct stability problems
- Understand cascade loops and feed-forward control
- Identify and correct problems with dead time in the process

Overview

To succeed in process control, the designer must first establish a good understanding of the process to be controlled. Since we do not wish to become too deeply involved in the process itself, we need to find a way of simplifying the representation of the process. This is done by adopting a technique of block diagram modeling of the process.

All processes have some basic characteristics in common and, if we can identify these, the job of designing a suitable controller is relatively easy. The trick is to make a reasonably accurate mathematical model of the process and use this model to find out what typical control actions we can use to make the process operate at the desired conditions.

The first part of this module deals with the modeling process, resulting in a system block diagram. From this analytical result an accurate selection of the type of measuring transducer as well as the final control element can be made. The rest of the module deals with other aspects of process control, namely the controller(s), functions, actions and reactions, function combinations and various modes of operation.

THE PROGRAM

Due to space limitations we have summarised this module's outline. For more detail please contact us.

Topic 12.1
Introduction
Process Management and Transducers

Topic 12.2
Basic Principles of Control Valves and Actuators
Fundamentals of Control Systems
Stability and Control Modes of Closed Control Loops

Topic 12.3
Digital Control Principles
Real and Ideal PID Controllers
Tuning of PID Controllers in Both Open and Closed Loop

Topic 12.4
Process Diagrams
Concepts and Applications of Feed-forward Control
Combined Feedback and Feed-forward Control
Long Process Dead-time in Closed Loop Control and the Smith Predictor
Basic Principles of Fuzzy Logic and Neural Networks
Self-Tuning Intelligent Control and Statistical Process Control
Module 13: Digital Signal Processing (DSP)

You will learn how to:

- Describe the fundamentals of Digital Signal Processing (DSP)
- Apply DSP technology to improve efficiency
- Analyse the frequency content of signals
- Correctly design digital filters
- Analyse the performance of DSP systems
- Identify the key issues in designing a DSP system
- Specify features and capabilities of commercial DSP applications

Overview

If signals are inherently discrete in time, the most natural way to process them is using digital methods. But for continuous time signals, we have a choice. Analog signals have to be processed by analog electronics while computers or microprocessors can process digital signals. Analog methods are potentially faster, since the analog circuits process signals as they arrive in real-time, provided the settling time is fast enough. On the other hand, digital techniques are algorithmic in nature. If the computer is fast and the algorithms are efficient, then digital processing can be performed in ‘real-time’ provided the data rate is ‘slow enough’. However, with the speed of digital logic increasing exponentially, the upper limit in data rate that can still be considered as real-time processing is becoming higher and higher. The major advantage of digital signal processing is consistency. For the same signal, the output of a digital process will always be the same. It is not sensitive to offsets and drifts in electronic components. The second main advantage of DSP is that very complex digital logic circuits can be packed onto a single chip, thus reducing the component count and the size and reliability of the system.

THE PROGRAM

Topic 13.1
Introduction
- Benefits of processing signals digitally
- Definitions of some terms
- DSP systems
- Some application areas
- Objectives and overview of the workshop

Converting Analog to Digital Signals and Vice Versa
- A typical DSP system
- Sampling
- Quantisation
- Analog-to-digital converters
- Analog reconstruction
- Digital-to-analog converters

Time Domain Representation of Discrete Time Signals and Systems
- Notation
- Typical discrete-time signals
- Operations on discrete-time signals
- Classification of systems
- The concept of convolution
- Autocorrelation and cross correlation of sequences

Topic 13.2
Frequency-domain Representation of Discrete-time Signals
- Discrete Fourier series for discrete-time periodic signals
- Discrete Fourier Transform for discrete-time aperiodic signals
- The inverse discrete Fourier transform and its computation
- Properties of the DFT
- The Fast Fourier Transform
- Computation of convolution using DFT

DSP Application Examples
- Periodic signal generation using wave-tables

Topic 13.3
Finite Impulse Response Filter Design
- Classification of digital filters
- Filter design process
- Characteristics of FIR filters
- Window method
- Frequency sampling method
- Parks-McClelland method
- Linear programming method

Infinite Impulse Response (IIR) Filter Design
- Characteristics of IIR filters
- Review of classical analog filter
- IIR filters from analog filters
- Direct design methods
- FIR vs. IIR

Topic 13.4
Digital Filter Realisations
- Direct form
- Cascade form
- Parallel form
- Software implementation
- Representation of numbers
- Finite word-length effects

Digital Signal Processors
- Common features
- Hardware architecture
- Special instructions and addressing modes
- General purpose microprocessors for DSP

Hardware and Software Development Tools
- DSP system design flow
- Development tools
Module 14: Data Acquisition Systems (DAS)

Duration: 4 WEEKS

You will learn how to:

• Install and configure a data acquisition system
• Choose and configure the correct software
• Apply state-of-the-art approaches in design of data acquisition systems
• Configure data communications systems
• Avoid the common pitfalls of designing a data acquisition system

Overview

A data acquisition and control system, built around the power and flexibility of a PC, may consist of a wide variety of diverse hardware building blocks from different equipment manufacturers. It is the task of the system integrator to bring together these individual components into a working system. The basic elements of a data acquisition system include sensors and transducers, field wiring, signal conditioning, data acquisition hardware, a PC with an Operating System, and data acquisition software. This module will equip students with the necessary know-how to put together such a system.

THE PROGRAM

Topic 14.1
Introduction
• What is data acquisition and control
• Fundamental principles of data acquisition and control systems
• Typical PC based applications

Analog and Digital Signals
• Classifications of signals
• Sensors and transducers
• Temperature transducers
• Strain gauges
• Single-ended and differential systems
• Sources and types of noise
• Field wiring and noise considerations
• Ground loops
• Common Mode voltages and CMRR
• Grounding/earthing and isolation techniques to reduce noise
• Cable shielding and grounding/earthing

Topic 14.2
Signal Conditioning
• Classification of signal conditioning hardware
• Distributed I/O
• Signal conditioning functions
• Instrumentation amplifiers
• Filters
• Isolation and over-voltage protection

Topic 14.3
Plug-in Data Acquisition Boards
• Advantages of plug-in systems
• Typical Analog to Digital (A/D) boards
• Analog input circuitry
• Analog to Digital board specifications
• Resolution/dynamic range/accuracy
• Sampling rate and Nyquist theorem

• Preventing aliasing
• Sampling techniques
• Speed versus throughput
• Typical Digital to Analog (D/A) boards
• Digital I/O boards
• Interfacing digital I/O
• Electromechanical vs. solid state relays
• Practical considerations in the use of digital I/O boards
• Counter Timer I/O boards

Topic 14.4
Serial Data Communication
• RS-232 Interface [review]
• RS-485 Interface [review]
• Communication protocols
• Error detection
• Troubleshooting serial data communications

Distributed and Standalone Controllers/Data Loggers
• Choice between external and internal systems
• Hardware structure of standalone devices
• Software and firmware design
• Practical applications of Data Loggers
• How to minimise communication bottlenecks

IEEE-488 (GPIB) Systems
• IEEE-488.1/IEEE-488.2 and SCPI specifications
• Hardware configuration
• Device types
• Basic communications
• Advanced communications
• Multiple device communications
• Problem diagnosis
• System specification
Module 15: Programmable Logic Controllers (PLCs)

Duration: 4 WEEKS

You will learn how to:

- Specify PLC hardware and installation criteria
- Describe PLC software structure
- Write medium level PLC programs (using ladder logic)
- Troubleshoot a typical PLC system
- Specify PLC systems

Overview

These topics are designed to benefit you with practical up-to-date information on the application of PLCs to the automation and process control of plants and factories. They are suitable for people who have little or no previous exposure to PLCs, but expect to become involved in some or all aspects of PLC installation. You will receive practical advice from experts in the field in order to assist you to correctly plan, program and install a PLC with a shorter learning curve and more confidence. While the program is ideal for electricians, technicians and engineers who are new to PLCs, much of the content will be of value to those who already have some basic skills, but need a wider perspective for larger and more challenging tasks ahead. The accompanying material includes contributions from a number of experts and will become a valuable reference document in your work. The information contained advances from the basics to challenge even the most experienced engineer in the industry today.

THE PROGRAM

Due to space limitations we have summarised this module’s outline. For more detail please contact us.

**Topic 15.1**
Introduction to the PLCs
Processors, power supplies and programming devices
Memory systems and I/O interaction
Digital Input/Output Systems
Analog Input/Output Systems
Special Function I/O and Serial Communication Interfacing
Good Installation Practices

**Topic 15.2**
Fundamentals of PLC Programming
Data Acquisition
Analog and Digital Control
Fault Tolerance - Spreading the Risk
Peripheral Equipment
Operator Interfaces

**Topic 15.3**
High Security PLC Systems
Simulation and Testing of Systems
Best Documentation Practice
HMI (Human Machine Interface)

**Topic 15.4**
Electrical Design and Construction
Functional Specification of the System
Configuration of the System
Installation and Commissioning
Working Examples of PLC Programs

Due to space limitations we have summarised this module’s outline. For more detail please contact us.
Module 16: Troubleshooting Industrial Electronics Components and Circuits

Duration: 4 WEEKS

You will learn how to:

- Recognise and efficiently troubleshoot common electronic component and circuit problems
- Demonstrate the construction and operation of common electronic components
- Utilise common electronic terminology
- Effectively apply the principles of analog meters, digital meters and oscilloscopes
- Identify electronic component symbols
- Identify components and read their values
- Implement procedures for the testing of electronic components and assemblies/sub-assemblies
- Confidently carry out simple repair procedures for the correction of faults on printed circuit boards

Overview

Electronic equipment can develop a wide variety of problems. Effective and efficient troubleshooting requires not only a fundamental understanding of how the equipment works, but also the ability to interpret the service manuals and circuit/wiring diagrams, access to [and the ability to use] the appropriate test and measurement equipment, and a logical troubleshooting methodology. This module lays the groundwork for proper troubleshooting and maintenance action.

THE PROGRAM

Topic 16.1
Introduction to Troubleshooting
- Troubleshooting basics
- Common troubleshooting techniques
- Gaining circuit familiarity
- Getting prepared for troubleshooting

Failure Analysis and Prevention in Electronic Circuits
- Failure symptoms
- Failure causes
- Failure types
- Some useful terms in failure

Device Troubleshooting I
- Tools for servicing
- Test and measuring instruments

Device Troubleshooting II
- Testing of passive components
- Testing of semiconductor devices
- Testing bipolar transistors
- Testing other active components
- Testing diodes, transistors and in-circuit semiconductors
- Using oscilloscopes
- Switches

Digital Systems Troubleshooting
- Moving from analog to digital
- Moving into digital circuits
- Typical faults in digital systems
- Digital circuit troubleshooters
- Digital integrated circuits
- PLD and memory definitions
- Practical tips
- Precautions

Display Troubleshooting
- CRT monitors
- LCD displays
- Plasma displays
- TFT screens

Topic 16.2
Power Supply and Subsystems Troubleshooting
- Power supplies
- Regulators
- Switched Mode Power Supplies
- Oscillators

- Amplifiers
- Troubleshooting RS-232 serial data standard
- Troubleshooting microprocessor based systems
Temperature as a Parameter for Testing, Signal Injection and Signal Tracing
- Effect of temperature on electronic circuits
- Testing
- Actual troubleshooting
- Signal injection
- Signal tracing

Phenomenal Troubleshooting
- Noise
- Intermittent problems
- Sources of interference
- Static discharge
- EMI/EMC and its sources
- Cross-talk

Topic 16.4
PCB Testing and Soldering Techniques
- What is soldering?
- Process of soldering
- Soldering tools
- Solder and flux
- Component forming
- Temperature range in soldering
- Component replacement
- Inspecting solder joints
- Unsoldering connections
- Additional soldering tips
- Additional de-soldering tips
- First aid steps
- Printed circuit board
- Troubleshooting of surface mounted PCBs
- Testing and troubleshooting with ATE

Maintenance and Safety Aspects
- Do we need maintenance?
- Types of maintenance
- Aims of maintenance
- Advantages of preventive maintenance
- Importance of sound maintenance management
- Maintenance policy
- Maintenance organisation
- Maintenance manuals
- Safety aspects
Module 17: Printed Circuit Board Design

Duration: 4 WEEKS

You will learn how to:

- Draw basic circuit diagrams with CAD software
- Design the Printed Circuit Board with PCB software
- Create the Gerber files for submission to a PCB manufacturer

Overview

Almost every piece of modern electronic equipment contains a Printed Circuit Board of some description. Before the advent of the Personal Computer, circuit schematics were drawn by hand, and the derived PCB layout was made with black tape on clear Mylar before being photographed and reduced to actual size. Nowadays the entire design process can be done on a PC, and for boards of low to medium complexity, the software is even free. This module covers the design process right from the start, when the circuit diagram is drawn, through to the stage where the output files can be submitted to a PCB manufacturer.

THE PROGRAM

Topic 17.1 Preparation
- Developing schematic diagram
- Specifying parts
- Specifying packages
- Specifying pin names
- Drawing up parts list

Topic 17.2 Overview of the Process
- The Netlist
- Making Netlist files
- Placing parts
- Routing traces
- Adding text

Topic 17.3 PCB Layout Part 1
- Projects
- PCB elements
- Board outlines
- Parts
- Nets, Ratlines and Routing

Topic 17.4 PCB Layout Part 2
- Copper areas
- Text
- Solder masks and cutouts
- Exporting Drill and Gerber files
- File formats
Duration: 4 WEEKS

You will learn how to:

- Provide an overview of current wireless networking offerings on the market
- Apply current wireless technology to industrial automation
- Implement your own simple Wireless LAN (WLAN) for your office and Industrial plant
- Implement simple radio telemetry links for SCADA systems
- Explain the strengths and weaknesses of the different wireless technologies
- Describe standards such as IEEE 802.15.4 and IEEE 802.11
- Implement effective security on a WLAN
- Describe how spectrum and frequency allocation is done
- Use the basic terminology and jargon used in this area

Overview

Wireless communications is being rapidly implemented in the industrial environment, with great success, provided certain ground rules are applied. These include ensuring a robust wireless link, correct integration with the wired communications systems, and proper data security. The most important objective of wireless communications networks must be to achieve similar capacities, bandwidths, responsiveness and availability to that of wire-based communications systems.

This module provides an in-depth coverage of the main Industrial wireless technologies viz. wireless modems, IEEE 802.11 wireless LANs (Wi-Fi) and IEEE 802.15.4 wireless PAN technology as implemented by a multitude of process control system vendors. It also covers some of the secondary technologies that are not known as industrial technologies per se, but which still find widespread application in industrial environments. These include Bluetooth, LP radio, mobile (cellular) data systems and Very Small Aperture Terminals (VSAT).