Ensure you and your company remain at the forefront of Industrial Automation
Join the next generation of automation engineers
Through innovative e-learning, participate from your home or office

WHAT YOU WILL GAIN:
• Skills and know-how in the latest technologies in instrumentation, process control and industrial automation
• Practical guidance from industrial automation experts in the field
• Knowledge from the extensive experience of instructors, rather than from only the theoretical information gained from books and college
• Credibility as the local industrial automation expert in your firm
• Networking contacts in the industry
• Improved career prospects and income
• An EIT Associate Degree in Industrial Automation

Visit our website: www.eit.edu.au
**Introduction**

Join the next generation of automation engineers. Embrace a well paid, intensive yet enjoyable career by taking this comprehensive and practical course. It is delivered by live distance learning and presented by some of the leading automation, instrumentation and control engineering instructors in the world today.

There is a critical shortage of automation, instrumentation and control engineers around the world now due to retirement, restructuring and rapid growth in new industries and technologies. The respected ISA organization estimated that at least 15,000 new automation engineers are needed annually in the US, alone. Many industrial automation businesses throughout the world comment on the difficulty in finding experienced automation engineers despite paying outstanding salaries. For example, about five years ago a gaping hole appeared and remains with control valve specialists being few and far between.

Often universities and colleges do not teach industrial automation as a core subject and much of the key training material (e.g. practical instrumentation and valve topics) necessary to arm you when commencing work as a successful automation, control and instrumentation engineer is missing from their curriculums. However, there are a few notable exceptions with some highly dedicated practitioners. Many of those universities and colleges that do teach industrial automation and control do so mainly from a theoretical point of view. Furthermore, lecturers often have little experience in industry due to the difficulty in attracting good engineers from the highly paid private sector.

The aim of this 18 month e-learning program is to provide you with core industrial automation skills.

The topics that will be covered are derived from the acclaimed IDC Technologies' courses attended by over 300,000 engineers and technicians during the past 16 years. There are seven threads running through the course to give you maximum, practical coverage in the field of industrial automation. These threads comprise of Instrumentation, Automation and Process Control, Electrical Engineering, Electronics, Industrial Data Communications, Process Plant Layout, Project and Financial Management and Chemical Engineering.

This practical course avoids too much emphasis on theory. This is rarely needed in the real world of industry where time is short and immediate results, with hard-of Instrumentation, Automation and Process Control, Electrical Engineering, Electronics, Industrial Data Communications, Process Plant Layout, Project and Financial Management and Chemical Engineering.

The Associate Degree 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 Associate Degree is also approved by the Institute as providing CPD.

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 courses. The EIT has obtained validation for CPD Points from the SAImechE (South African Mechanical Institute), COET (Chamber of Engineering Technology) and SAIEE (South African Institute of Electrical Engineers), who are voluntary associations recognized by ECSA (Engineering Council of South Africa).

To view our list of validated courses and programs, visit ECSA’s website www.ecsa.co.za and refer to the CPD Activities. South African students who complete an EIT associate degree successfully can apply for recognition by SAQA, who have determined that the course is at Level 6 in the National Qualifications Framework (equivalent to National First Degree or Higher Diploma: www.saqa.org.za/show.asp?include=focus/ld.htm)

**EIT Accreditation Status**

The Engineering Institute of Technology (EIT) is an institute for higher learning. It has emerged from its founding organization, IDC Technologies, which is an international provider of practical, technical training. Since its conception in 1991, three hundred thousand engineers, technicians and technologists have been trained globally. The EIT has received recognition, endorsement and/or accreditation (varies by course and location) from authorizing bodies based around the world.

These include:

- **IEEE** - The IEEE, based in the USA is the world's leading professional association for the advancement of technology, with more than 355,000 members in more than 160 countries. The EIT is an IEEE Continuing Education Provider.

- **The Institute of Measurement and Control** in the United Kingdom - Britain's foremost professional body for the Automation Industry. The Associate Degree 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 Associate Degree is also approved by the Institute as providing CPD.

- **South Africa - The Engineering Council of South Africa (ECSA)**

**VALUE plus!**

As part of the incredible value we have built into this course, you also receive:

- **Two places on any IDC Technologies public 2-day workshop**
- **OR**
- **Two places at any IDC Technologies conference** (conference component only, excludes workshop if available)

**PLUS**

- A library of 30 technical eBooks

All of this is valued at over US$5000!

You may also be eligible for a tax deduction on your personal income tax — contact your tax advisor for more information.

*to be used within 2 years of course enrollment and subject to availability. Your fee for this course must be up to date. The offer is for workshop or conference fee only and does not include travel, accommodation or other costs. The EIT is not responsible for cancelation or postponement of IDC Technologies workshops and conferences. Other conditions may apply at our discretion.

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*“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 course.”*

Gary Burrowes, BHP Billiton

*“This has been the best study process I have gone through and for advancing the career it is a must. The course 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

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**EIC - EIT is a Participating Partner with the Engineering Institute of Canada [EIC] and EIT programs and courses can be utilized by members to register for Continuing Education Units [CEUs]. The 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. The EIC is a member of the International Association for Continuing Education and Training, with headquarters in Washington, DC.”**

**Asia Pacific Utilities Group Supplier Management System - EIT has achieved full registration on the Asia Pacific Utilities Group Supplier Management System (APUGS).**

About the Engineering Institute of Technology (EIT)

The Engineering Institute of Technology is a private Registered Training Organization. EIT is a sister company of the well known and reputable engineering training organization, IDC Technologies. IDC has been operating for over 20 years, from offices throughout the world, delivering practical short courses to well over 300,000 engineers and technicians. The finest engineering lecturers, with extensive real engineering experience in industry, are drawn from around the world. The learning is delivered to students through a blend of synchronous and asynchronous online [e-learning] technologies, which includes live lectures and remote laboratories. The EIT offers education awards in a growing array of engineering fields.

Many (perhaps, most) engineering faculties at universities and colleges experience a significant challenge delivering the course-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. Many institutions offer online training, with no interaction or practical components and composed mainly of self study and perhaps supplied recordings. This format offers very little in the way of motivation or practical skills and can leave students feeling isolated. The live, interactive format of the EIT's online programs allow expert lecturers to present from anywhere in the world, to anyone in the world, and students can interact and socialize with lecturers and fellow students. Students not only have access to international expert lecturers, but are provided with a worldwide network of peers. The EIT's online learning provides cost-effective, flexible training with no compromise on quality.

About the International Society of Automation (ISA)

Founded in 1945, the International Society of Automation is a leading, global, non-profit organization that is setting the standard for automation by helping over 30,000 worldwide members and other professionals solve difficult technical problems, while enhancing their leadership and personal career capabilities.

ISA is one of the foremost professional organizations in the world for setting standards and educating industry professionals in automation. ISA Standards help automation professionals streamline processes and improve industry safety, efficiency, and profitability. Over 150 standards reflect the knowledge from more than 4,000 industry experts around the world. Since 1949, ISA has been recognized as the expert source for automation and control systems consensus industry standards.

ISA provides leadership and education in the professions that it serves, assisting engineers, technicians, and research scientists, as well as many others, in keeping pace with the rapidly changing industry. It also publishes books and technical articles, and hosts conferences and exhibitions for automation professionals to gain access to the latest product developments and industry knowledge.

Furthermore, ISA certifies industry professionals. ISA certification provides an objective, third-party assessment and confirmation of a person’s skills, and gives them the opportunity to stand out from the crowd and be recognized.

Accreditation is a voluntary process of regulating instructional programs and is conducted by an association or an agency. The Accreditation Board for Engineering and Technology (ABET) accredits curricula and assists academic institutions plan educational programs leading to degrees for engineers, engineering technologists, engineering technicians, and others engaged in engineering work. ISA is ABET’s lead Society for accreditation of engineering and technology programs that include “instrument,” “instrumentation,” “measurement,” “metrology,” “control,” “automation,” or similar modifiers in their titles.

To enroll please contact Maria.Davidson@eit.edu.au
COURSE STRUCTURE

The course is composed of 72 topics, within 21 modules. These cover the following seven engineering threads to provide you with maximum practical coverage in the field of industrial automation:

- Instrumentation, Automation and Process Control
- Electrical Engineering
- Electronics
- Industrial Data Communications and Networking
- Mechanical Engineering
- Project Management
- Chemical Engineering

The modules will be completed in the following order:

1. Instrumentation for Automation and Process Control
2. Fundamentals of Chemical Engineering
3. Control Valve Sizing, Selection and Maintenance
4. Fundamentals of Process Plant Layout and Piping Design
5. Process Control for Engineers and Technicians
6. Tuning of Industrial Control Loops
7. Distributed Control Systems (DCS) for Engineers and Technicians
8. Programmable Logic Controllers (PLCs) for Automation and Process Control
9. Best Practice in Industrial Data Communications
10. Advanced Process Control for Engineers and Technicians
11. Boiler Control and Instrumentation for Engineers and Technicians
12. Hazardous Areas for Engineers and Technicians
14. Hazops for Engineers and Technicians
15. Shielding, EMC/EMI, Noise Reduction, Earthing and Circuit Board Layout
16. Wireless, Ethernet and TCP/IP Networking
17. Radio Telemetry Systems for Industry
18. SCADA Systems for Industry
19. Motor Protection, Control and Maintenance Technologies
20. Power Distribution
21. Project Management for Engineers and Technicians

For detailed information on the content and breakdown of modules, see pages 13 to 33

Who Should Attend

Anyone who wants to gain solid knowledge of the key elements of industrial automation to improve their work skills and to further their job prospects:

- Electrical Engineers and Electricians
- Maintenance Engineers and Supervisors
- Energy Management Consultants
- Automation and Process Engineers
- Design Engineers
- Project Managers
- Instrument Fitters and Instrumentation Engineers
- Consulting Engineers
- Production Managers
- Chemical and Mechanical Engineers
- Instrument and Process Control Technicians

Even those who are highly experienced in industrial automation may find it useful to attend some of the topics to gain know-how in a very concentrated but practical format.

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 course 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 instructors via phone, fax and e-mail.

Live Webinars

During the program you will participate in 72 live interactive sessions/webinars with the instructors and other participants from around the world. Each webinar will be scheduled at 2 varying session times, so that you can select the one which is most convenient to you. Webinar times are only finalized after registrations close, as we need to know which time-zones all participants are based in before we can compile a schedule. Upon registration you will receive a questionnaire regarding your time availability. We guarantee that at least one session time, for each webinar, will fall into your preferred time slot.

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 Course

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.
Benefits of Live E-learning

- Attend lessons in a live, virtual classroom with your instructors 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 course instructors and coordinator for the duration of the course
- 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 Associate Degree in Industrial Automation

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 course and ensure you are able to put theory into practice.

As research shows, no matter how gifted and experienced an instructor (and we believe ours are some of the best worldwide), no one learns from an instructor only presenting course 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 instructor that you are able to internalize this knowledge, "take ownership of it" and apply it successfully to the real world. You should note that there is some degree of overlap between the practical sessions between the different units to reinforce the concepts and to look at the issues from different perspectives.

Traditional distance learning thus presents challenges in achieving these goals but we believe today with the modern e-learning technologies available combined with outstanding instructors that we can achieve these goals and give you an equivalent or indeed even better experience than on a traditional university campus. Practical sessions may be added, deleted or modified by the instructors to ensure the best outcome for students.

Why EIT?

- Our lecturers are selected and recruited from amongst the top engineers/instructors 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 course prospectus, the courses are aimed at practicing 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 course 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 course accordingly.
- We have experience in training over 300,000 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 course.
- The course 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 course.

Course Fees

Your course fees include weekly webinars with leading engineering and technical experts, 30 technical eBooks, all course materials, software and postage, plus grading and support from the course coordinators and instructors. 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.

For more information or to enroll please contact Maria.Davidson@eit.edu.au
Comprehensive e-Books and Associated Documentation

You will receive 30 of our up-to-date technical e-Books to add to your library. Together these texts contain over 5000 pages of valuable know-how distilled from years of experience in presenting these courses throughout the world.

Participants only completing selected topics will receive only the relevant documentation.

1. Practical Instrumentation for Automation and Process Control
2. Practical Control Valve Sizing, Selection and Maintenance
3. Practical Fundamentals of Chemical Engineering
4. Fundamentals of Process Plant Layout and Piping Design
5. Practical Tuning of Industrial Control Loops
6. Practical Programmable Logic Controllers [PLCs] for Automation and Process Control
7. Practical SCADA Systems for Industry
8. Practical Boiler Control and Instrumentation for Engineers and Technicians
9. Practical Hazardous Areas for Engineers and Technicians
11. Practical Hazops for Engineers and Technicians
12. Best Practice in Industrial Data Communications
13. Practical Wireless, Ethernet and TCP/IP Networking
14. Practical Power Distribution
15. Practical Project Management for Engineers and Technicians
16. Setting Up, Understanding and Troubleshooting of Industrial Ethernet and Automation Networks
17. Troubleshooting and Problem Solving of Modbus Protocols
18. Practical Earthing, Bonding, Lightning & Surge Protection
19. Electrical Drawings and Schematics
20. Practical Electrical Substation Safety
21. Power System Harmonics, Earthing and Power Quality - Problems and Solutions
22. Electrical Maintenance for Engineers and Technicians
23. Variable Speed Drives for Instrumentation and Control Systems
24. Practical Analytical Instrumentation in On-Line Applications
25. Introduction to the Selection, Installation, Commissioning and Maintenance of Fiscal Flow and Metering Equipment
26. Practical Industrial Flow Measurement for Engineers and Technicians
27. Process Control for Engineers and Technicians
29. Practical Hydraulic Systems: Operation and Troubleshooting
30. Best Practice in Process, Electrical & Instrumentation Drawings and Documentation

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 course. e-Books are available in hard copy at 50% of the recommended retail price. Contact us for pricing details.

Entrance Requirements

This Engineering Institute of Technology associate degree is an accelerated, practical, work-oriented course. 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 formalize 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 enrollment application and may recommend pre-course studies if required.

Associate Degree Preparation Course

If you are unsure if you have a strong enough grasp of the fundamental knowledge required for this course, or you simply want to refresh your skills and experience e-learning in a shorter course, we recommend that you consider the EIT's engineering studies preparation course. This intensive 4-month course 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 course.

On completion of this course, 50% of the course fees can be used as a credit towards your fee for an EIT Associate Degree course.

Hardware and Software Requirements

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

We are Flexible with your Commitments

We recognize that personal circumstances can make it difficult to complete the course in the time available. We will be flexible about the time you require to complete the course. 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 commencement date to complete the course.

You can withdraw from the course at any time and receive a Certificate for the topics you have completed. However, completion of all 72 topics will earn you the EIT Associate Degree in Industrial Automation.
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 course(s)?

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

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

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

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

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

“I can do those courses 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 courses.” Kacst, Saudi Arabia

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

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

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

“Had completed courses previously. Good content.” Woodside

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

“Better choice of topic.” Rockwell RA

“Believed to be good quality based on previous training courses 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 course that I am currently enrolled in also had all the outcomes I was looking for to further my career.” Rio Tinto

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

“I have done a few IDC courses 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 course delivery including its quality support structures” OneSteel

“Course 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.” Pwerco, New Zealand

“Better choice of topic.” Rio Tinto

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

“Convenience.” Rio Tinto

“To be perfectly honest with the small amount of research on various courses I did the courses 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

“Course 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

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

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

“Their courses are standard and course 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 course payment.” Kinyara Sugar Ltd, Uganda

“The most practical and technical offerings by the most qualified instructors 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 instructor and class instead of working totally on my own.” Mitchell Technical Institute

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

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

“Possibly the most recognized online institution within my industry.” DRA, South Africa
Frequently Asked Questions

What are the advantages of studying online?
We know that many potential students have part or full-time employment as well as family commitments, so finding the time to study a classroom-based course is not always possible. Many students also have geographical, travel and time limitations and do not have an accessible institution or training provider. We have taken this into consideration and developed an affordable, flexible, online approach to training. This means that you can study from anywhere, with minimum downtime from work – but still have the necessary interactive learning experience. The software we use does not require very fast internet connection or a sophisticated computer. A basic connection and hardware are sufficient.

What are the fees?
The EIT provides distance education to students located almost anywhere in the world – it is one of the very few truly global training institutes. Course fees are paid in a currency that is determined by the student's location. A full list of fees in a currency appropriate for every country would be too complex list here and, with today's exchange rate fluctuations, difficult to maintain.
To find out the fees for your location, contact us at enquiries@eit.edu.au .

What do I need?
An adequate Internet connection, speakers and a microphone. A headset is recommended. The necessary software and course materials are provided by us.

Doesn't it get boring? How can an e-Learning course be interactive?
Boredom can be a real risk in any form of learning; however, we use an interactive approach to our e-Learning – with live sessions [instead of recordings] for most presentations. The webinar software allows everyone to interact and involves participants in group work, including hands-on exercises with simulation software and remote laboratories where possible.
You can communicate with text messages, or live VoIP speech, or can even draw on the whiteboard during the sessions. This all helps to keep you motivated and interested.

What do live webinars involve?
These are live, interactive sessions over the Internet. You will join the instructor and other participants from around the world in an online 'virtual classroom' where you are able to watch a presentation, and communicate with the instructor and other students via audio, text messaging or drawing on the whiteboard. Each webinar is between 60 and 90 minutes in duration and the sessions are scheduled at 2 or 3 different times during the presentation day. This allows you to select the session which is most convenient.

What if I cannot join or I miss a live webinar?
Webinars are recorded and available to students upon request. One requirement of the course is that you join at least 70% of the live sessions. The live webinars offer the opportunity to interact with the presenter and other participants from around the globe - an essential yet enjoyable part of the learning process.
Circumstances such as on-site work can make attendance difficult at times. These situations need to be clearly communicated with your e-learning coordinator. Feedback from the recordings may be required and assignment submission maintained.

When will the sessions take place? When will I receive a webinar schedule?
The webinar schedule is not put together until after registrations close. The reason for this is that the course is promoted globally and we often have participants from several time zones. When you enroll you will receive a questionnaire which will help us determine your availability. When all questionnaires are returned we create a schedule which will endeavor to meet everyone's requirements.
Each webinar runs 2 or 3 times during each presentation day and we try our best to ensure that at least one session falls into your requested time frames. This is not always possible, however, due to the range of locations of both presenters and students. If you are unable to attend the webinars scheduled, we do have some options available. Contact the EIT for more details.

Can I complete the course in less time?
Our courses actually require ‘attendance’ and participation at the live webinars. The interaction which takes place is an important part of the learning process. Our experience has shown that the interactive classes work exceptionally well and students are far more likely to stay motivated, enjoy the program, and complete the course successfully. See also 'What if I cannot join or I miss a live webinar?’ In addition, accelerating the course would be quite onerous for most students.

How much time do I need? How long is the course?
The course reading and assignments may consume anywhere from 5 to 10 hours per week. This will vary depending on the course subject matter and your existing knowledge.
The EIT does not use a traditional semester-based system, which means that you can complete the qualification faster without long breaks. Each associate degree course is delivered over an intensive 18 months. We do break for about 4 weeks per year for traditional festive seasons.
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 course.

Guest Speaker and Advisory Panel

**RICHARD E. MORLEY**

Richard E. Morley, best known as the father of the Programmable Logic Controller (PLC), is a leading visionary in the field of advanced technological developments. Mr. Morley (Dick) is a member on the Board of Directors of various companies across the United States and has worked in high tech industries since the beginning of solid-state electronics.

He is currently Chairman of the Board of NCMS (National Center for Manufacturing Sciences) and has a proven track record in the founding of successful high-tech companies for where he provides initial product concept and a continuing technological presence.

He is a nationally recognized expert in the field of computer design, artificial intelligence, automation and is an authority on the factory of the future. Mr. Morley is an engineer, consultant and inventor. His inventions include the PLC [Programmable Logic Controller], which now stands in the Smithsonian Institute. He holds more than twenty United States and foreign patents. Mr. Morley is well known as a lecturer, has written extensively for such publications as Manufacturing Systems magazine and Manufacturing Automation magazine. He has published many works of his own. His latest book, ‘Out of the Barn’, was published in October 2002 and another book, ‘The Technology Machine’, was published in September 1999. Mr Morley founded the angel investment group; the Breakfast Club. He is currently an active member with this group of investors having participated in more than 100 startup companies in the New Hampshire area.

He was the former Director of Advanced Technologies for Gould, Inc. He is a Gould Fellow of Science and Engineering, a Fellow of SME, Bios LP and ICS. In addition, he was awarded the 1990 Entrepreneur of the Year by Inc. magazine, Merrill Lynch and Ernst and Young.

He is a 1991 recipient of The Franklin Institute’s Howard N. Potts Medal, and holds the Prometheus Medal placing him into the Automation Hall of Fame. International IEN ranked him 3rd in the “Top 100 Most Significant Industrial Products of the 20th Century” for his work with the PLC.

In October 1999, ISA (Instrumentation, Systems and Automation Society) honored him with the “Life Achievement Award” and Fortune magazine awarded him their “Heroes of Manufacturing Award” in March 2000.

Recognized as one of the giants in the field by the Engineering Society of Detroit, he has extensive experience in high-tech consulting and is involved in new product development at the highest management levels. Currently he works out of his barn in New Hampshire where he and his wife have been home to more than two dozen foster children.

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Program Designer and Advisory Panel

**Dr Steve Mackay**

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 courses 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 Dean of Engineering at the Engineering Institute of Technology, a growing engineering training and education 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 throughout the world. He feels that all engineering businesses need to think globally and keep experimenting with new approaches. Currently, he is actively involved in research and implementation of remote lab technology.

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Program Designer and Advisory Panel

**Dr Rodney Jacobs**

Rodney has over 20 years experience in the gold mining industry, underground as well as specializing in Metallurgical operations in the Gold Plants. He has worked predominately in the instrumentation, process control and automation field, and is responsible for hardware and software designs associated with instrumentation. His areas of special interest include PLCs, SCADA systems, process control and programming. Having spent many years on the shop-floor, Rodney has built up a vast amount of hands-on practical experience.

Rodney is currently active as a Consulting Engineer in the field of instrumentation, both to the mining industry as well as to other general engineering companies, which require specialized solutions. He has also lectured in Electronics, Electrical Engineering and Digital Systems, at a university level. Rodney feels that people are the most important asset of any organization and has a qualification in Psychology to complement his Engineering knowledge and experience. Finally, Rodney has presented numerous IDC workshops in the United States, England, Ireland, Scotland, Bahrain, United Arab Emirates, Iran, South Africa, Australia, New Zealand and Malaysia.
International Expert Speaker Faculty

Course Presenter

Ian Verhappen  BSc, P. Eng, ISA Fellow, ISA Certified Automation Professional

Ian has been involved in digital communications since 1994, installing the first multi-vendor Foundation Fieldbus project in 1996. Since then Ian has served as both, a leading Project Engineer/Designer and an external/cold eyes review consultant for a number of companies involved in pulp and paper, mining, food processing, water and wastewater, oil sands processing, petrochemical and refining industries.

Ian is co-author, with Augusto Pereira, of ISA’s popular “Foundation Fieldbus Pocket Guide”. Also under Ian’s guidance as editor, is the Foundation Fieldbus End User Advisory Council’s “Engineering Design Guide, Foundation Fieldbus document AG-181”. This is the definitive guide for the complete life cycle for Fieldbus projects. The “Guide” has been translated into German, Japanese, Chinese and Russian, demonstrating how widely it is used as the basis for many corporate and project specifications. Ian is also an active volunteer with ISA, serving as Vice-President of the Standards and Practices 2005/6 and was the person responsible for the formation of the ISA-100 Industrial Wireless committee on which he continues to participate. Ian is also heading up the Fieldbus Foundation’s High Speed Ethernet Remote I/O development team.

Ian is known as a digital communications evangelist and his passion for the topic has taken him around the world to share his experiences. Ian has the ability to explain technology in simple terms that can be understood by others without the same level of theory or experience, a rare quality! Ian’s seminars are less presentation than they are interactive conversations loaded with practical examples and experiences, his enthusiasm for the topic is contagious and leaves you not only more knowledgeable about the topic but excited to go ‘make it work’.

Course Presenter

Geoff Bottrell  HNC, DMS, MIEE, Senior Hazardous Areas Engineer

Geoff has been working in the instrumentation, measurement and control fields for over twenty-five years and has spent the past fifteen years specializing in Hazardous Areas, Intrinsic Safety and Instrumentation Drawings. Geoff began his career at Kent Instruments, as a service engineer working in both the UK and East Africa. His experience ranges from systems design functions, on-site trouble shooting to technical and commercial customer support.

Recently Geoff has taken on the responsibility of mentoring engineers in training, in addition to the presentation of engineering workshops in the process control and measurement field. His positive interactive style to teaching has made him popular with course attendees worldwide.

Course Presenter

Dave Macdonald  BSc (Hons) Inst. Eng, Senior Instrumentation Engineer

Throughout his career Dave has been involved in the application of instrumentation and control technology to industrial and chemical processes. As a senior instrument engineer in the UK and later with AECI Ltd in South Africa he was involved in managing the design and implementation projects for process control systems from conceptual design to commissioning.

Over the past 6 years Dave has specialized in the technology of risk reduction through the application of safety instrumented systems. He has worked as a training instructor and team leader for hazard studies and safety system reviews in chemical processing plants and boiler systems. With IDC Technologies he has developed several workshops to reflect recent developments in international best practices.

In the past few years, Dave has lectured on this and related topics to hundreds of Engineers and Technicians in Canada, the United Kingdom, Ireland, Australia and South Africa. His positive and enthusiastic approach combined with his broad knowledge of the subject makes this a not-to-be-missed learning experience.

Course Presenter

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

Over the past 16 years, George has developed an extensive amount of experience in design work in power electronics and electro-optical systems and in surge protection, earthing and EMC experience in the military and commercial market.

George’s portfolio of achievements include EMC and Switch Mode Power Supply Design for high reliability military applications together with UPS, EMC, Power Supply, Servo Amplifier, Battery and Inverter Design for industrial systems, such as solar panel applications, vehicle management, specialized computer systems and design of a high current starter for vehicle plants. He is an enthusiastic instructor with a wealth of knowledge under his belt. Much can be gained from his entertaining style, as thousands of others have benefited from his knowledge.
International Expert Speaker Faculty

Course Presenter

Deon Reynders  
Pr Eng, BSEE MBA, Senior Data Communications Engineer

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

Deon is a practical, hands-on person and a highly entertaining speaker. He has received excellent reviews from his thousands of course 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. He is a passionate, enthusiastic and knowledgeable professional engineer. You will walk away from this workshop with a wealth of know-how which you can immediately apply to your work.

Course Presenter

John Westover  
BSc ChEng, M Eng Sci Process Integration

John has over 27 years of experience in the oil and gas industry, and his career has taken him from Rocky Mountains and the Arctic Coast of Alaska to various locations in Australia, with several stops in between. He has previously worked for both owner/operators such as Amoco and BP and the engineering company, Fluor and has first hand understanding of the unique needs and requirements of various stakeholders.

He first earned the respect of his operations and maintenance co-workers when he proved some thermocouples were not working properly – he had to wear a safety harness and climb a 35-tray distillation column outside the ladder cage to get some data (the data verified his theory). After reaching the age of 40, John completed his Masters degree, specifically looking at how process integration could be systematically used to reduce the weight of offshore platforms [which resulted in a paper for the Society of Petroleum Engineer]. Since then his career has started to transition into training and mentoring roles. He developed a practical course for Monash University, showing how the principles of Chemical Engineering taught in school could be applied to real engineering problems and has consistently been one of the most highly rated courses by the students. He has also developed remote training modules for operations and maintenance personnel for a facility expansion with new technology in Pakistan.

With Johns experience and knowledge, you will walk away from this workshop with skills that you can immediately apply to your work.

Course Presenter

N.S. Nandagopal  
B.Sc [Chem Eng], M.Sc, P.E., Chemical Engineering Consultant

Nanda has over twenty-five years of industry and academic experience in the areas of process plant layout and piping design. His experience includes work in process design, plant design, pipe stress analysis, and piping engineering and design. While at Brown and Root, Nanda designed and engineered major piping systems for offshore platforms; including high temperature and high-pressure lines. He has served on the Board of Directors of Society of Piping Engineers and Designers [SPED] and is constantly in touch with the trends and current practices in process plant and piping design.

Nanda has extensive experience in teaching short, intense, review courses for engineering license exams in the USA and is a registered Professional Engineer [PE] in the State of Texas, USA. He is a passionate teacher who truly enjoys conveying complex technical concepts in a practical, down to earth manner. An effective communicator, Nanda receives excellent reviews from course participants.

Course Presenter

Kobus Harmse  
B.Eng[Chem Eng], B.Eng Hons, Senior Technical Manager

One word describes Kobus. Passionate! He loves his work in chemical engineering. He has worked in a number of roles at Sasol in the chemical engineering area ranging from the ammonia business, to ultra high purity hydrogen and solvents. Latterly he’s been responsible for optimization support in the Monomers and Polymers business. He spent a year doing detail engineering in Texas which he found a tremendously positive influence on his career.

Kobus has received outstanding reviews with his presentations of this course overseas; with many participants commenting on his strong practical bias thanks to his experiences in chemical engineering.
International Expert Speaker Faculty

Course Presenter

**John Lawrence**  B.Sc [Hons] M.Sc B.Com [Hons]

In today's hype up world, one is hesitant to describe anyone as ‘outstanding’, but John Lawrence has distinguished himself over the last 15 years with excellent course reviews.

John has 20 years of experience as a project and departmental manager for a multinational oil company, focusing on designing and managing the infrastructure of the telecommunications, data communications and IT systems. In the past 5 years, John has worked extensively for a number of multi-national clients, managing projects including facilities management, budgeting and financial forecasting.

When John is not consulting or lecturing, he enjoys increasing his own skills by reading and writing about state-of-the-art technology topics and how to optimize Return On Investment (ROI) for the overall IT infrastructure. John is a dedicated professional who has trained engineers and technicians throughout the world.

Course Presenter

**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 for industry. He also presents numerous courses 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.

With his extensive experience electrical engineering, you will walk away from this workshop with valuable know-how that you can apply immediately to your work.

Course Presenter


Ian's engineering career has spanned over 45 years. Starting as an apprentice, he moved up to become an engineering manager of a large chemical facility. The early part of his career included a period of military service over some 25 years including service in the paratrooper core and then completing his service as a voluntary training officer.

Ian has a wide range of industry experience, including contracting, the food industry, paper, marine boiler and engine automated control systems during secondment to GEC in the UK, then later with rubber processing, chemical and allied products. Ian has also served on a number of technical committees, for the SABS and Department of Labor and also served as chairman of ICME SA (KZN) and the ECA (KZN). He currently serves as a member for the ECSA (Engineering Council of S A) registration committee for technicians and technologists.

Over the last ten years, Ian has been running his own consulting practice involved in a variety of activities, including training, hazardous area classification, control and management of hazardous locations, electrical and mechanical inspection and auditing for compliance to various act and regulations, electrical consulting and energy management, accident and incident investigations, boiler and pressure vessel inspections.
Module 1: Practical Instrumentation for Automation and Process Control

You will Learn How to:

- Specify and design instrumentation systems for:
  - pressure
  - level
  - temperature
  - flow measurement
- Apply your knowledge of instrumentation and control valves
- Install process equipment correctly
- Understand the problems with installing measurement equipment
- Troubleshoot instrumentation systems and control valves
- Understand the major technologies used for instrumentation and control valves
- Isolate and rectify instrumentation faults

Overview

These topics are designed for engineers and technicians who need to have practical knowledge of selection, installation and commissioning of industrial instrumentation and control valves.

In many respects a clear understanding and application of these principles is the most important factor in an efficient process control system. You can only achieve excellent control of your process when your instrumentation provides the correct information. You will learn how to achieve effective results for the industrial processes you are responsible for, including the design, specification and implementation of control and measurement equipment. The material focuses on real applications, with attention to special installation considerations and application limitations when selecting or installing different measurement or control equipment.

THE PROGRAM

Topic 1.1
INTRODUCTION
- Basic concepts
- Definitions
- Overview of pressure, level, temperature and flow
- Overview of valves

Topic 1.2
PRESSURE MEASUREMENT
- Principles
- Sources
- Transducers and elements
- Specifications
- Installation issues

Topic 1.3
LEVEL MEASUREMENT
- Principles
- Simple sight glasses
- Buoyancy tape systems
- Hydrostatic pressure
- Ultrasonic measurement
- Radiation measurement
- Electrical measurement
- Density measurement
- Installation issues

Topic 1.4
TEMPERATURE MEASUREMENT
- Principles
- Thermocouples
- Resistance temperature detectors
- Thermistors
- Liquid-in-glass, filled, bimetallic
- Pyrometers
- Installation issues

Topic 1.5
FLOW MEASUREMENT
- Principles
- Differential pressure flowmeters
- Open channel flow measurement
- Oscillatory flow measurement
- Magnetic flow measurement
- Positive displacement
- Ultrasonic flow measurement
- Mass flow measurement
- Installation issues

Topic 1.6
PROCESS CONSIDERATIONS
- Transmitters
- Noise
- Material of construction
- INTEGRATION OF THE SYSTEM
- Individual instrument error and total error
- Testing and commissioning
Module 2: Practical Fundamentals of Chemical Engineering (for Non-Chemical Engineers)

You will Learn How to:

• Understand the fundamentals of chemical engineering
• Perform simple process calculations
• Troubleshoot process equipment and provide simple fixes
• Contribute to process design activities
• Do simple specifications of pumps and heat exchangers
• Understand mass transfer phenomena including agitation scale-up
• Understand process drawings and link them to plant operation
• Apply safety guidelines to a process or chemical plant
• Understand basic chemical engineering jargon and terminology

Overview

These topics will cover the fundamental concepts of chemical engineering and provide you with a solid working knowledge associated with it. If you are a non-chemical engineer this course will enable you to confidently talk to and work effectively with chemical engineers and process equipment.

Many technical professionals today find themselves working with large scale chemical processes even though they don’t have formal training in chemical engineering. This program intends to fill these gaps and provide you with knowledge of chemical engineering fundamentals along with the ability to apply this knowledge. By the end you will be familiar with the fundamentals of chemical engineering, process design considerations and troubleshooting of process equipment.

Pre-Requisites

An elementary understanding of engineering concepts such as fluid flow, heat and mass transfer is useful; however a revision will be covered at the start.

THE PROGRAM

Topic 2.1

INTRODUCTION: THE CHEMICAL PROCESS
• Process Flow Diagrams (PFDs)
• Piping and Instrumentation Diagrams (Pand IDs)
• Process legends used in flow sheets

STOICHIOMETRY
• Dimensions and units
• Processes and process variables
• Basic chemical calculations
• Material and energy balance
• Combustion

FLUID MECHANICS
• Fluid statics and its applications
• Basic equations and fluid flow
• Flow of compressible fluids
• Transportation and metering of fluids
• Agitation and mixing

HEAT TRANSFER AND ITS APPLICATIONS
• Heat transfer by conduction in solids
• Principles of heat flow in fluids
• Heat transfer to fluids
• Radiation heat transfer
• Heat-exchange applications
• Evaporation

MASS TRANSFER AND ITS APPLICATIONS
• Distillation
• Leaching and extraction
• Principles of diffusion
• Absorption
• Drying of solids

CHEMICAL ENGINEERING THERMODYNAMICS
• Fundamental quantities
• Thermodynamics
• Volumetric properties of pure fluids
• Heat effects
• Phase equilibria
• Chemical reaction equilibrium
• Conversion of heat into work by power cycles
• Refrigeration and liquefaction

Topic 2.2

CHEMICAL KINETICS
• Basic definitions
• Introduction to reactor design
• Design for single reactions
• Mixing of fluids
• Fluid particle reactions
• Solid-catalyst reactions

PROCESS EQUIPMENT DESIGN
• Storage vessels
• Pressure vessels
• Heat exchangers
• Evaporators and crystallizers
• Agitators
• Filters
• Dryers
• Process hazards and safety measures

PROCESS CONTROL AND INSTRUMENTATION
• Process instrumentation
  - Temperature
  - Pressure
  - Level
  - Flow
• Process control fundamentals
You will Learn How to:

- Understand what happens inside a control valve from basic fluid mechanics point of view
- Appreciate the difference between cavitation and flashing, and know what choked flow is
- Do simple calculations to determine CV values
- Recognize severe service applications and have an appreciation for the methods of tackling the problems associated with such applications
- Identify the different types of control valves commonly in use and understand the relative advantages of each
- Choose between different characteristics on offer and specify seat leakage rates
- Select size actuators for linear and rotary applications and know the relative advantages of pneumatic, hydraulic and electric types
- Select materials for bodies, trims, packing boxes, and gaskets
- Make use of a computer sizing program to assist with the selection of control valves
- Understand the failure modes for control valves and demonstrate new approaches to troubleshooting

Overview

It is claimed that the majority of control valves throughout the world have not been correctly sized and that large numbers operate on manual mode. Whether this is true or not is difficult to establish but we do know that the method of sizing and selecting a control valve for a specific application is generally not well understood. Although there are many factors that need to be taken into account the subject is not difficult to understand if dealt with in a logical manner. We also find that many maintenance problems result from people treating the symptoms of a problem rather than tackling the true cause - a basic understanding of the principles is all that is usually needed to solve the problem for good.

Training Methodology

The latest educational methods and strategies will be employed. This module is designed to maximize benefits from the outset. Questions are encouraged throughout to provide you with the opportunity to discuss with the presenter and others, specific problems and appropriate solutions.

THE PROGRAM

Topic 3.1

INTRODUCTION TO CONTROL VALVE THEORY
- Introduction
- Definition of a control valve
- Energy types
- What is happening inside a control valve
- Cavitation
- Flashing
- Choked flow
- Valve Coefficient Cv

DIFFERENT TYPES OF CONTROL VALVES
- Globe valves
- Butterfly
- Eccentric disk
- Ball
- Rotary Plug
- Diaphragm and pinch

CHARACTERISTICS
- Equal percent
- Linear
- Quick opening
- Selection method

Topic 3.2

HIGH PRESSURE DROP APPLICATIONS
- Cavitation control
- Cavitation elimination
- Low noise
- Diffuser plates
- Chokes
- Disk stack technology
- Pressure balanced trim

USE OF COMPUTER PROGRAM FOR VALVE SIZING

EXAMPLES OF HIGH PRESSURE DROP APPLICATIONS
- Water - pump bypass
- Steam - turbine bypass
- Gas - pressure reducing
- Oil - choke valve

ACTUATORS
- Pneumatic
- Hydraulic
- Electric
- Sizing on rotary valves
- Sizing on linear valves
- Mounting considerations
- Manual overrides
- Accessories

Pre-Requisites

No specialist knowledge or skills are required - only a technical background so that there is an understanding for such factors as the difference between pressure and force. These topics are a good introduction to control valves as well as an important refresher course for control valve specialists who benefit from the back-to-basics approach.
Module 4: Fundamentals of Process Plant Layout and Piping Design

You Will Learn How to:

- Understand plant layout fundamentals and procedures
- Apply fundamental principles of chemical process technology
- Use appropriate plant layout terminology and symbols
- Use process plant equipment
- Design piping systems and apply engineering principles
- Identify terminology, symbols and abbreviations in piping design
- Create and understand documents and drawings
- 3D modeling of plants and piping systems

Overview

Process plants such as refineries and petrochemical plants are complex facilities consisting of equipment, piping systems, instruments, electrical systems, electronics, computers, and control systems. The design, engineering and construction of process plants involves multidisciplinary team effort. Plant layout and design of piping systems constitute a major part of the design and engineering effort. The objective is to design safe and dependable processing facilities in a cost effective manner. The fact is that there are few formal training programs with a focus on plant layout and design of piping systems, therefore most of the required skills are acquired while on the job, reducing productivity and efficiency.

These topics will cover the fundamental principles and concepts used in process plant layout and piping design. You will have an opportunity to learn and discuss the techniques and procedures used in the design and engineering of complex process plants, including fundamentals of plant layout, the equipment used, design principles and procedures. You will also understand fundamentals of piping system components and the specification and design of these components. Practical examples from actual projects will be used extensively to illustrate the principles and drive home the point. You will also be provided with high quality technical materials that will prove useful for many years.

THE PROGRAM

Topic 4.1

INTRODUCTION TO PROCESS PLANT LAYOUT AND PIPING DESIGN

- Plant layout fundamentals
- Procedures and workflow methods
- Physical quantities and units

INTRODUCTION TO CHEMICAL PROCESSING METHODS

- Basic principles of chemical technology - unit operations and unit processes
- Process Flow Diagrams [PFDs], process variables and stream information
- Process utilities

PROCESS AND INSTRUMENTATION DIAGRAMS ([P&IDs])

- Fundamentals of P&IDs
- Use of P&IDs in plant and piping design
- Instruments and instrument symbols
- Components of control valve manifolds
- Meter runs for flow meters

Topic 4.2

EQUIPMENT USED IN PROCESS PLANTS

- Process equipment - reactors, towers, exchangers and vessels
- Mechanical equipment - pumps, compressors and turbines
- Equipment drawings, nozzle specifications and vendor drawings
- Equipment foundations and supports

PLANT AND PIPING DESIGN DOCUMENTATION AND TOOLS

- Equipment arrangement drawings
- Equipment lists
- Piping and Instrumentation Diagrams ([P&IDs])
- Piping line lists
- Piping specifications and codes
- Piping isometrics
- Bill of materials
- 3D models

PLANT LAYOUT AND PLOT PLANS

- Plant layout specifications
- Guidelines and codes for plant layout
- Safety considerations
- Plot plans
- Equipment arrangement drawings

Topic 4.3

FUNDAMENTALS OF PIPE

- Piping materials
- Pipe dimensions and pipe data
- Pipe joining methods
- Pipe representation
- Common abbreviations

PIPING SYSTEM COMPONENTS

- Fittings - elbows, tees, reducers and end caps
- Fitting makeup and dimensions
- Flanges and flange ratings
- Valves, instrumentation, instrument connections and drains
- Pipe racks, pipe supports, anchors and guides

PIPE ROUTING

- Piping isometrics
- Piping plans, sections and elevations
- 3D representation
Module 5: Practical Process Control for Engineers and Technicians

You Will Learn How to:
- Understand and apply the fundamentals of process control and the latest techniques
- Tune PID control loops
- Connect cascade loops
- Understand cascade loops and feedforward control
- Correct long dead-times in a loop
- Specify and design the analog loop requirements for a plant using PID control
- Identify and apply the essential building blocks in automatic control
- Tune control loops with significant dead-times
- Demonstrate a clear understanding of analog process control and tune analog loops
- Explain concepts used by major manufacturers using current technology in the process control field

Overview
These topics cover all the essentials of process control and tools to optimize the operation of your plant and process, including the ability to perform effective loop tuning. Practical process control is aimed at engineers and technicians who wish to have a clear understanding of the essentials of process control and loop tuning, as well as how to optimize the operation of their particular plants or processes. Mathematical theory has been kept to a minimum with the emphasis throughout on practical applications and useful information.

Practical Sessions
You will perform hands-on, practical exercises using professional simulation software which is yours to keep.

THE PROGRAM

Topic 5.1
INTRODUCTION
BASIC CONTROL CONCEPTS
- Typical manual control
- Feedback and feedforward control
- Block diagrams
BASIC PRINCIPLES OF CONTROL SYSTEMS
- On/Off control
- Modulation control
- Principles of closed loops control
- PID of control moves
Practical session

Topic 5.2
STABILITY AND CONTROL MODES OF CLOSED LOOPS
- Cause of instability in control loops
- Change of stability through PID control modes
- Methods to improve stability
- Principles of closed loop control tuning
Practical session
IDEAL PID vs REAL PID
- Non-field-interactive or ideal PID
- Field-interactive or real PID
- Distinguish between process noise and instability
- Selection of ideal or real PID
Practical session
CASCADE CONTROL
- Equation types for cascade control
- Initialization and PV-tracking
- Use of multiple outputs in cascade control
- Tuning procedure for cascade control
Practical session

Topic 5.3
FEEDFORWARD CONTROL
- Feedforward balance - a control concept
- Tuning procedure for feedforward control
Practical session
COMBINED FEEDBACK AND FEEDFORWARD CONTROL
- Concept of combined control with incremental algorithms
- Tuning procedure for combined control
Practical session
LONG DEAD-TIME IN CLOSED LOOP CONTROL
- The problem of long dead-time in closed loops
- Use of process simulation for process variable prediction
- Tuning procedure for control loops with long dead-time
Practical session
ALARM HANDLING AND PROCESS SECURITY
RANGE OF CONTROL AND INSTRUMENTATION IN INDUSTRIAL PROCESS CONTROL
PRACTICAL APPLICATIONS
- PLC systems
- Stand alone loop controllers
Practical session
EXPERT SYSTEM AND MODEL BASED SELF TUNING CONTROLLERS
- Basic auto tuning
- Expert system control
- Model based adaptive
Module 6: Practical Tuning of Industrial Control Loops for Engineers and Technicians

You Will Learn How to:

• Tune loops effectively and apply fundamentals of tuning loops
• Apply open and closed loop tuning rules effectively
• Get the best PID settings right first time
• Troubleshoot to achieve optimally tuned control loops
• Apply step-by-step descriptions of the best field-proven tuning procedures
• Apply typical procedures for troubleshooting tuning problems
• Tune more control loops in less time with consistently excellent results
• Understand the practical rules of thumb for tuning systems
• Be proficient at tuning with a detailed knowledge of
  - Open Loop Tuning
  - Closed Loop Tuning (including such classics as Ziegler Nichols Tuning and Lambda Tuning)
• Determine the minimum settling time for a control loop
• Gauge the optimum amount of filtering or dampening to apply to the measurement
• Handle problems such as valve hysteresis, stiction and non linearities
• Tune complex loops ranging from cascade to feedforward
• Use derivative control for the best tuned loop

Overview

This section is designed to train you in the latest procedures for the tuning of Industrial Control Loops using a minimum of mathematics and formulas. Loop Tuning refers to the complex skill of adjusting PID controller parameters so that the control loop performs satisfactorily under all the operational conditions it is expected to cope with. This skill cannot be acquired by merely reading books or manuals, it requires practice and practical experience and this course will provide you with the solid fundamentals in this area. You will gain the skills required to tune a controller for optimum operation.

An optimally tuned processed loop is critical for a wide variety of industries ranging from food processing, chemical manufacturing, oil refineries, pulp and paper mills, mines and steel mills. Although tuning rules are designed to give reasonably tight control, this may not always be the objective. Some thought needs to be given when retuning a loop as to whether the additional effort is justified as there may be other causes of the poor control. These issues will be discussed in some detail. By the end of these topics you will have the skills to troubleshoot and tune a wide variety of process loops.

THE PROGRAM

Topic 6.1
FUNDAMENTALS OF TUNING LOOPS
• Processes, controllers and tuning
• PID controllers - P, I and D modes of operation
• Load disturbances and offset
• Speed, stability and robustness
• Gain, dead time and time constants
• Process noise
• Feedback controllers
• How to select feedback controller modes
 Practical Session

Topic 6.2
THE DIFFERENT TUNING RULES
• Ten different rules compared
• Tables of typical tuning settings
• When to use them/when not to use them
• 28 rules of thumb in tuning
 Practical Session

Topic 6.3
AUTOMATED TUNING
• Self tuning loops
• Adaptive control
 Practical Session

TUNING OF MORE COMPLEX SYSTEMS
• Cascade systems - tuning of them
• Feedforward, ratio, multivariable systems
• Interactive loops tuning
• Dead time compensation
• Practical limitations
 Practical Session

GOOD PRACTICE
• Good practice for common loop problems
• Flow control loop characteristics
• Level control loop characteristics
• Temperature control loop characteristics
• Pressure control loop characteristics
• Other less common loops
 Practical Session

Practical Sessions

Throughout this module, simulation software is used to simulate real loops and to give you EIGHT real hands-on exercises in a safe practice environment. You will see the simulated process output respond to your input and configuration changes on the loop controller. You will reinforce and apply the concepts learned using simulation exercises that are close to the real world of the plant.
Module 7: Practical Distributed Control Systems (DCS)

You Will Learn How to:

- Understand the architecture and operation of Distributed Control Systems (DCSs)
- Design the overall DCS and process control system
- Specify planned DCSs
- Improve process performance for your plant
- Understand the key ergonomic issues in design of operator displays
- Apply advanced control strategies to your plant control system
- Use your existing DCS process control capabilities more effectively
- Design and create a consistent and effective alarm philosophy for your installation
- Recognize and deal with human problems in interfacing to alarm systems

Overview

This module will cover the practical application advantages of the modern distributed control system (DCS) and how to maximize your return on this significant investment in both hardware and software. This includes the monitoring of the effectiveness and return on the on-line process and control system performance including due diligence on system alarm management. A variety of causes and cures for how these situations occur and can be corrected will be addressed as part of the course curriculum.

Most of the process control functionality that should be in a DCS can be configured in terms of well tried and virtually standard combinations of function blocks. All DCSs have a comprehensive library of these function blocks but few operations outside the hydrocarbon industries implement the control schemes required for reasonably comprehensive process stabilization (“straight lines on screens”) and constraint compliance (“operating hard up against the limits”) capabilities on which control systems are justified.

This module will provide you with the tools to realize how to effectively use an integrated distributed control system and consequently optimize your process and profitability.
Module 8: Practical Programmable Logic Controllers (PLCs) for Automation and Process Control

You Will Learn How to:
• Understand fundamentals of PLC hardware and software
• Write a simple PLC program
• Troubleshoot a PLC system
• Engineer a complete PLC system
• Apply the essentials of IEC 61131-3

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 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, 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.

Practical Sessions
You will undertake a series of practical sessions, ranging from elementary to advanced, based on the PLCs supplied. Full working solutions will be distributed to you after you have attempted the practicals.

The practicals include:
• Write simple ladderlogic programs
• Creation and use of a single scan ‘pulse’
• Developing a simple program:
  - Valve limit switch monitoring
  - Pushbutton steps around a loop
  - Simple timers (a ‘reticulation’ timer)
  - Sequential startup
• Multiple recipe batch selection
• PID control loop

THE PROGRAM

Topic 8.1
INTRODUCTION
• Introduction and brief history of PLCs and alternative control systems
• Why PLCs have become so widely accepted
• Lingering concerns about PLCs

FUNDAMENTALS OF PLC HARDWARE
• Block diagram of typical PLC
• PLC processor module - memory organization
• Input and output section - module types

FUNDAMENTALS OF PLC SOFTWARE
• Methods of representing Logic, Boolean Algebra, instruction code and graphical presentation
• Fundamental ladder logic instruction set
• Comparison of different manufacturers, memory and data representation and instruction code

USING LADDER LOGIC FOR SIMPLE DIGITAL FUNCTIONS
• The basic rules
• Comparison of relay ladder diagrams
• The concept of the ‘scan’ and how to apply it
• Contact ‘normal’ states
• Positive and negative logic
• Basic Boolean functions

USING REGISTERS (WORDS)
• Number systems
• Types of register data
• Timers and counters
• Bit shift and rotate
• Table functions
• Register [Matrix] logic functions

Topic 8.2
GOOD PROGRAMMING HABITS
• Keeping track of addresses and data used
• Looking ahead - how will programs be maintained?
• Practical methods to improve quality: organization of code, thorough documentation and simplifying changes

GOOD INSTALLATION PRACTICE
• Location of hardware
• Good wiring practice
• Cable spacing, power distribution and wire numbering
• Reducing noise and interference

ADVANCED CONTROL WITH PLCs
• The concept of reusable logic
• Examples, drive logic and alarm handling
• Use of advanced programming functions
• Matrix logic
• Example: simple display driver

BATCH PROCESSES AND SEQUENTIAL CONTROL
• Creating a ‘stepper’
• Step advance
• Fault detection and recovery
• Multiple recipes or alternative paths
• Sequential function charts

PID CONTROL
• The importance of timing and scan time
• When PID is not always appropriate: intermittent measurements - Long transport delays

SAFETY PROGRAMMABLE SYSTEMS
• Why regular PLCs should not be used for safety functions
• Programmable electronic logic solvers
• Safety certification
• Certified programming systems
• Application examples
• Growth of networked safety devices and certified networks
• Integrated safety systems

Topic 8.3
INTRODUCTION TO IEC 61131-3
• Concepts
• Common elements
• Programming languages: structured text
• Function block diagrams
• Ladder diagrams
• Instruction list
• Sequential function chart

OPC
• Introduction to OPC
• Architecture

SYSTEM CHECKOUT AND TESTING
• Development and verification of code
• Factory acceptance testing
• Testing procedures
• Emulating missing hardware
• Emulating process responses
Module 9: Best Practice In Industrial Data Communications

You Will Learn How to:

- Understand best practice in industrial data communications design, installation and commissioning
- Design and install your own fully operational industrial data communications systems
- Integrate different industrial communications protocols and standards into a complete working system

Overview

These topics will outline best practice in designing, installing, commissioning and troubleshooting industrial data communications systems. In any given plant, factory or installation, there are a myriad of different industrial communications standards used and the key to successful implementation is the degree to which the entire system integrates and works together. With so many different standards on the market today, the debate is not about what is the best - be it Foundation Fieldbus, Profibus, DeviceNet or Industrial Ethernet 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.

This module will distill all the tips and tricks and give the best proven practices to follow. The main steps in using today’s communications technologies involve selecting the correct technology and standards for your plant based on your requirements; doing the design of the overall system, installing the cabling and then commissioning the system. Fiber optic cabling is generally accepted as the best approach for physical communications but there are obviously areas where you will be forced to use copper wiring and indeed, wireless communications. These topics outline the critical rules followed in installing the data communications physical transport media, ensuring trouble-free installation for years to come. 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 — knowledge of the minute details of the protocols is not necessary.

THE PROGRAM

Topic 9.1 Cabling Infrastructure
- Noise, earthing and shielding
- Protection against dust and moisture
- Copper/fiber
- Cable and connector standards
- Splicing
- Connector attachment
- Drivers and detectors
- Grounding and termination
- Protection against transients

Topic 9.2 Physical Layer Standards
- RS-232
- RS-485
- 4-20 mA

Topic 9.3 Industrial Protocols
- TCP/IP
- Modbus and Modbus TCP
- DNP3
- 60870 SCADA

Topic 9.4 Industrial Networks [1]
- Modbus Plus
- Data Highway Plus
- HART

Topic 9.5 Industrial Networks [2]
- DeviceNet
- Profibus
- Foundation Fieldbus

Topic 9.6 Industrial Networks [3]
- Ethernet/IP
- Profinet
- Foundation Fieldbus HSE

Practical Sessions

There are several practical exercises and assignment sessions to give you the confidence and experience to work with industrial data communications networks.
Module 10: Practical Advanced Process Control for Engineers and Technicians

You Will Learn How to:

- Understand the essentials of Advanced Process Control (APC)
- Grasp the key differences between the various technologies
- Perform simple APC design strategies and implementations
- Be able to perform PID control
- Troubleshoot simple APC problems
- Identify processes suited to APC

Overview

In today’s environment, the processing, refining and petrochemical business is becoming more and more competitive and every plant manager is looking for the best quality products at minimum operating and investment costs. The traditional PID loop is used frequently for much of the process control requirements of a typical plant. However there are many drawbacks in using these, including excessive dead time which can make the PID loop very difficult (or indeed impossible) to apply. Advanced Process Control (APC) is thus essential today in the modern plant. Small differences in process parameters can have large effects on profitability; get it right and profits continue to grow; get it wrong and there are major losses. Many applications of APC have pay back times well within a year.

APC does require a detailed knowledge of the plant to design a working system. Considerable attention needs to be given to the operators to ensure that they can apply these new technologies effectively.

THE PROGRAM

Topic 10.1
JUSTIFICATION OF ADVANCED CONTROL
- Advanced vs. classical control
- Advanced on-line control vs. statistical process control
- Comparison of pay back time on real examples

FUNDAMENTALS OF PROCESS CONTROL
- Processes, controllers and tuning
- PID Controllers - P, I and D modes of operation
- Load disturbances and offset
- Speed, stability and robustness
- Gain, dead time and time constants
- Process noise and feedback controllers

FUNDAMENTALS OF TUNING PID LOOPS
- Open and closed loop tuning
- Ziegler Nichols
- Fine tuning for different process types
- Lambda tuning
- Ten different rules compared
- Cascade systems
- Feedforward control and deadtime
- Models and disturbances

INTERNAL MODEL CONTROL (IMC)
- Open loop model in parallel with the process
- Control system in two blocks
- Equivalence with a classical controller
- Disturbances rejection and control
- IMC and delays and feed forward

MODEL PREDICTIVE CONTROL (MPC)
- Single input / output vs. multivariable control
- Example on a binary column Causality graph
- Constraints and planning ahead
- Different models

MODEL REPRESENTATIONS
- State space and transfer function representation
- Impulse response representation

MODEL IDENTIFICATION
- Identification - what and how?
- Black and gray box models
- Causality graph of the unit

APPLICABLE TO THE CONTROL OF TWO DIFFERENT UNITS ON A PROCESS SIMULATOR
- Complete application (identification, controller design, control and optimization)

REFERENCES AND MODELS
- Overall formulation and purpose
- Study of Kalman algorithm

CONTROL FORMULATION PROBLEM
- Quadratic criterion vs. geometric control
- Importance of the horizon length
- Use of the weight matrix
- Handling output constraints along the horizon
- Projection of measured and unmeasured disturbances along the horizon
- Final quadratic problem formulation and resolution
- Off-line pre-processing
- On-line calculations

REFERENCES AND MODELS
- Hard constraints on manipulated variables
- Set values and soft constraints on control variables
- Rejection of disturbances

CONTROL FORMULATION PROBLEM
- Complete application (identification, controller design, control and optimization)
Module 11: Practical Boiler Control and Instrumentation for Engineers and Technicians

You Will Learn How to:

- Understand the objectives of the principal boiler control functions
- Recognize and understand typical boiler control diagrams and their design intentions
- Contribute to the setting up and tuning of boiler control loops
- Design effective:
  - Boiler feed water control
  - Furnace draft measurement and control
  - Steam demand and firing rate control
  - Main steam and reheat steam temperature control
  - Flue gas analysis and fuel combustion trimming controls
- Recognize the importance of boiler safety control and start-up interlocks
- Explore advanced control strategies for improved boiler plant efficiency

Overview

You will gain knowledge on two subjects that are essential for anyone involved in using or applying controls to boilers. These are a basic knowledge of boiler and combustion processes and a basic knowledge of those control and instrumentation practices relevant to most boiler plant applications. The control training includes a review of the SAMA and ISA symbol standards used for depicting control system details. The training then proceeds in a series of topics to describe the basic requirements and typical control solutions for the main control and safety functions in boilers. These functions are structured into individual topics allocated to feedwater supply and drum level, furnace air and the control of draft pressure, combustion controls, steam pressure and temperature controls. The combustion control module addresses the issues of dynamic response of the fuel and air feeds with examples of how ratio control, feedforward signals and cross limiting methods are applied to ensure good load following.

The program includes a study of the basic principles of burner management systems and includes the measures used to support furnace safety through the enforcement of start up procedures and purge sequences. The requirements for burner management systems to be engineered as safety instrumented systems to IEC 61511 are examined and the implications for equipment design are discussed. The topics are supported by a series of practical study exercises with answers provided to assist the understanding of key issues.

Introduction

These topics introduce the basic practices of controls systems and safety controls for industrial steam generating boilers. The focus is on the control and safety requirements applicable to most types of boilers from small gas-fired units to large multi-fuel installations. This module will provide you with training in how control and instrumentation is designed to manage the main variables such as drum water level, furnace draft, combustion fuel and air conditions. Burner management systems are introduced with their principal features including flame safety systems. The essential safety requirements for boilers and burners are identified and the corresponding safety interlocks are explained as practical solutions in accordance with the latest safety standards.

Practical Sessions

There are practical exercises and assignment sessions to give you the confidence and experience to work on the installation, operation and maintenance of boiler plants.

Pre-Requisites

Fundamental knowledge of basic boiler plant and operation thereof and some understanding of control systems.

THE PROGRAM

Topic 11.1

ESSENTIAL OF BOILER PROCESSES AND THEIR CONTROL FUNCTIONS

- Objectives of boiler controls
- Boiler processes in block diagrams to show key inputs and output variables
- Hazards of boiler operations
- The main control functions in boilers and furnaces
- Furnace air and draft controls

Topic 11.2

PRINCIPLES OF THE MAIN CONTROL FUNCTIONS

- Principles of drum level measurement
- Principles of drum level controls and protection systems
- Principles of combustion controls
- Master pressure controls for multiple units
- Basic steam temperature control
- Essential of burner management systems
Module 12: Practical Hazardous Areas for Engineers and Technicians

You Will Learn How to:

• Demonstrate a basic understanding of the hazards associated with electricity near flammable gases and vapors
• Correctly approach design and installation of explosion protected apparatus safely in hazardous areas
• Understand the terminology used with Hazardous Areas
• Classify hazardous areas
• Detail the types of apparatus that can be used in a given hazardous area
• Explain the types of equipment that can be used in hazardous areas
• Understand safety and operational aspects of hazardous areas
• Understand system limitations in using hazardous areas protection
• Detail the key areas of the national codes of practice

Overview

This module will provide you with an understanding of the hazards involved in using electrical equipment in potentially explosive atmospheres. It is based on the international IEC79 Series of Standards. Explosion-protected installations can be expensive to design, install and operate. The wider approaches described in these standards can significantly reduce costs while maintaining plant safety. The module will explain the associated terminology and its correct use. It covers area classification through to the selection of explosion-protected electrical apparatus, describing how protection is achieved and maintained in line with these international requirements. Standards require that engineering staff and their management are trained effectively and safely in Hazardous Areas and these modules are designed to help you fulfill that need.

Pre-Requisites

You will require a basic understanding of instrumentation and electrical theory for this section to be of greatest benefit. No previous knowledge of hazardous area installation is required.

THE PROGRAM

Topic 12.1
HAZARDOUS AREAS
• Introduction: explosion consequences
• Risk assessment
• Properties of flammable materials
• Definitions
• Classification system: sources of release and zoning
• Classification of apparatus: grouping and temperature

Topic 12.2
STANDARDS
• British standards
• European
• North American
• International

CERTIFICATION and APPROVALS
• Marking and identification
• Notified bodies
• Authorities
• IEx, EEx and AEx schemes
• ATEX directives in Europe
• Principles of Ex protection
• Component, apparatus and systems certification

Topic 12.3
PROTECTION
• Theory and definitions
• Practical aspects and limitations of use
• Flameproof Ex d
• Increased Safety Ex e
• Non-Incendive Ex n
• Pressurization Ex p
• Oil-Immersion Ex o
• Sand-filling Ex q
• Encapsulation Ex m
• Intrinsic Safety Ex i
• Special Ex s

Topic 12.4
INSTALLATION
• General requirements for all types of protection
• Selected specific requirements
• Earthing and bonding
• Operation and maintenance of apparatus

INSPECTION AND MAINTENANCE
• Requirements
• Visual close and detailed types
• Use of tools and test equipment
• What to look out for

You Will Learn How to:

- Determine required SIL ratings using at least 3 different methods as listed in IEC 61511
- Assess your plant’s compliance with the latest international safety standards
- Understand the fundamentals of IEC 61511 and IEC 61508 which you can apply immediately to your plant
- Help your company to comply with the best available practices for their safety control systems
- Get a practical understanding of the key sections of IEC 61511 and 61508 without wading through hundreds of pages of standards documents
- Configure safety systems to minimize or avoid spurious trips and create the potential to reduce production losses.
- Know what can be done and what should not be done with PLCs and smart sensors

*The IEC 61511 standard is effectively the operating company’s guide to the management, planning and execution of state of the art risk reduction measures using instrumentation and control equipment. IEC 61511 effectively merges the concepts of the groundbreaking USA standard ANSI/ISA-84-1996 with the European practices founded in IEC 61508.

Overview

For project managers and engineers involved with hazardous processes, this module of the course focuses on the management, planning and execution of automatic safety systems in accordance with IEC 61511, the newly released international standard for process industry safety controls. IEC 61511 has been recognized by European safety authorities and by USA based process companies as representing the best practices available for the provision of automatic safety systems. The content is structured into two major parts to ensure that both managers and engineering staff are trained in the fundamentals of safety system practices.

Practical Sessions

There are at least five practical exercise sessions to give you the hands-on experience you will need to: test your understanding of risk reduction principles, apply fault tree analysis methods to evaluate risk levels, specify safety performance requirements, determine SIL targets, decide on system architectures and perform reliability evaluations.

THE PROGRAM

Topic 13.1
AN OVERVIEW OF SAFETY INSTRUMENTED SYSTEMS FOR MANAGERS
- The principles of safety-instrumented systems including the concepts of risk reduction, safety integrity levels and the essential design and performance requirements of safety control systems.
- The scope and application of the IEC standards 61508 and 61511 and their principal requirements.
- Essential features of safety PLCs
- The safety life cycle

Topic 13.2
SAFETY REQUIREMENTS SPECIFICATION
- How hazard analysis and risk assessment leads to the safety requirements specification
- Demand mode and continuous mode methods for risk reduction
- LOPA and Risk graph methods for determination of SIL targets
- Fault tolerance and redundant architectures

Topic 13.3
SAFETY SYSTEM EQUIPMENT SELECTION AND APPLICATION SOFTWARE
- Essential features of field devices
- Instrument selection and issues of certification
- Safety PLCs and networks
- Application software activities and tools

Topic 13.4
PERFORMANCE EVALUATION, TESTING AND MAINTENANCE OF SAFETY SYSTEMS
- Basic reliability analysis and how it benefits the end user
- Diagnostics and proof testing for improved performance
- The benefits of safety certified and smart instruments
Module 14: Practical HAZOPS* for Engineers and Technicians

*Hazard and Operability Studies

You Will Learn How to:

- Implement HAZOP as part of risk and safety management
- Identify strengths and weaknesses of the HAZOP approach
- Select optimum teams and gain information
- Use HAZOP procedure and explain it to the team at the first meeting
- Format workshop records and make recommendations and rank risks
- Be an effective leader
- Work with the HAZOP team secretary
- Determine cost effectiveness of remedial measures
- Identify types of HAZO and alternatives to a HAZO
- Use popular HAZOP software packages
- Follow-up action files and closeout of actions

Overview

This module will concentrate on awareness level training for managers, engineers and technicians in the practical application of hazard and operability workshops (known as HAZOP). Training takes the form of an introductory presentation followed by interactive examples where you can obtain an understanding of the HAZO technique and HAZOP team leaders can practice the required skills. HAZOP is widely used for identifying hazards in an industrial process and for assessing the potential consequences where there are risks of harm to persons, the environment or to assets.

The HAZO technique is fully recognized and recommended throughout industry by professional engineering institutions, government regulators and insurance companies. It is one of the principle risk management tools required by most government regulators for industrial processes worldwide. HAZOP is applied at both the design stage and throughout the life of a process plant, where it supports the safety and operational failure modes and possible harm to persons, environment or assets. HAZO methods have been extended to searching for hazards in operational procedures in many other fields including electronic controls and emergency planning procedures.

This module will describe the role of HAZOP within a framework of risk management techniques that support the field of Process Hazard Analysis. The training will cover the 4 phases of HAZOP activities, which comprise: Planning, preparation, examination and reporting with particular emphasis on the details of the examination phase in which guidewords are systematically applied to parts of a process or stages of an operation to test for deviations from design intent. A number of practical exercises support the training information and allow you to test your understanding of the material provided in the training manual. The content extends to include risk assessment techniques such as FTA and determination of safety integrity levels (SILs) for safeguarding using safety instrumented systems.

Hazard studies interact closely with process design and safety engineering solutions in the critical stages of engineering projects. Understanding these interactions will assist to plan your work efficiently and to contribute effectively to the reduction of risks in the workplace. You will learn how information flow from HAZOP supports safety management throughout the life cycle of the plant. The HAZO techniques and safety system practices described are based on the latest international practices including the guidelines in IEC 61822 for HAZO studies.

Practical Sessions

There are at least five practical exercise sessions to give you the hands-on experience you will need to develop your skills in applying HAZO method to some basic process plant examples in continuous and batch processes.

THE PROGRAM

Topic 14.1

INTRODUCTION TO THE PRINCIPLES OF HAZO
- The how, when and why outline of Hazard and Operability Studies (HAZO)
- Hazard studies and regulations
- The six level life cycle model
- Typical HAZO workshop

Topic 14.2

THE HAZO EXAMINATION PHASE
- Defining the parts for study
- Generating deviations with guidewords
- Worked examples of process HAZO for continuous plant
- Procedural HAZO for sequential operations and batch processes

Topic 14.3

PLANNING AND LEADERSHIP OF HAZO WORKSHOPS
- Duties of the team leader
- Make up of the study team
- Leading the sessions
- Recording and reporting methods

Topic 14.4

FROM HAZO TO HAZARD ANALYSIS AND SILS
- Fundamentals of risk assessment and the risk matrix
- Risk reduction and layers of protection
- The role of safety instrumented systems and determination of SIL targets
- Hazard analysis methods of FMEA, FTA and LDPA
Module 15: Practical Shielding, EMC/EMI, Noise Reduction, Earthing and Circuit Board Layout of Electronic Systems

You Will Learn How to:

- Identify, design correctly and fix EMC/EMI problems
- Know why and how to earth a circuit effectively
- Efficiently diagnose noise problems
- Effectively design to filter at MHz frequencies
- Minimize the four noise coupling mechanisms
- Understand the function of the signal earth versus the signal return
- Earth a cable shield correctly
- Reduce DC power bus noise
- Select cables appropriately
- Know when to shield and when to filter
- Effectively earth mixed analog and digital signals
- Minimize pulse ringing and rounding problems
- Reduce earth loop noise
- Reduce emission and susceptibility problems
- Create a check list 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 earthing and shielding techniques. Learning how to fix 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, these topics will give you the tools to approach earthing and shielding issues in a logical and systematic way. The circuit board layout section concentrates on design and layout of circuits and components on a printed circuit board. The overall focus is on useful design and systems issues; not about regulations and standards. You will take this material back with you to your work and apply the key principles immediately to your design and troubleshooting challenges.

Pre-Requisites

Some working knowledge of basic electrical engineering principles is required, although there will be a revision at the beginning of the workshop. No prior EMC or electrical noise knowledge is necessary.
Module 16: Practical Wireless Ethernet and TCP/IP Networking

You Will Learn How to:

- Use current Wireless LAN (WLAN) technologies
- Apply WLANs to industrial automation
- Implement a simple WLAN for your office and industrial plant and interface it to Ethernet
- Assess strengths and weaknesses of the different WLAN technologies
- Operate IEEE 802.11 WLANs
- Implement effective security on Wireless and Ethernet LANs
- Conduct a site survey in preparation for WLAN implementation

Overview

The use of Wireless and Ethernet in industrial and plant floor environments has grown dramatically in the last few years. Industrial users face a wide range of options when designing and implementing plant-level Wireless and Ethernet networks. Great success is being achieved using Wireless, provided certain ground rules are applied. These topics cover IEEE 802.3 Ethernet LANs and IEEE 802.11 WLANs, as well as all the supporting technologies. These issues will be addressed in a clear and practical manner, enabling you to apply the technology quickly and effectively in your next project. By the end of this module you will have a clear understanding of the choices available to you in designing and implementing your own Wireless and associated Ethernet LANs.

Pre-Requisites

A basic working knowledge of data communications and applications is useful, but is not essential. The program starts at a very basic level and advances to a solid practical implementation level. However with the outstanding IDC documentation; everything is detailed in a simple-to-understand manner for future reference.
Module 17: Practical Radio Telemetry Systems for Industry

You Will Learn How to:

- Implement simple radio telemetry links for SCADA systems
- Understand the jargon, terminology and latest techniques
- Design and install an effective radio telemetry link
- Perform simple path loss calculations
- Troubleshoot radio telemetry communication problems
- Specify the main components of radio, satellite and microwave telemetry links
- Conduct a site survey
- Implement effective security on radio, wireless and Ethernet networks
- Explain the infrastructure requirements for effective systems
- Outline future trends in SCADA and telemetry systems

Overview

These topics have been designed in conjunction with radio telemetry experts from throughout the world (the SCADA list) and aim at providing you with all the critical information you will need. You will start with a review of radio and wireless fundamentals to ensure you are brought up to speed with the basics. The essentials of data communications (and Ethernet) are then reviewed as they apply to radio telemetry systems. A review of wireless LAN systems is undertaken with a comparison of radio modems, along with the fast growing topic of cellular radio data services. Protocols are a key part of all radio telemetry systems and we investigate the importance of them together with the challenges associated with radio. Satellite and microwave systems are given a brief overview, followed by performance analysis. A discussion on radio telemetry systems would not be complete without sketching out the key issues of SCADA systems and alarm management. The overall network architecture of radio telemetry systems is then detailed.

You will conclude with an examination of troubleshooting techniques and the vital topic of security and encryption. These topics reflect today’s emphasis on using open protocols and networking standards such as DNP3, TCP/IP and Ethernet off-the-shelf hardware and software to keep the costs down. You will gain real life skills with a selection of case studies, used to illustrate the key concepts with examples of real-world radio telemetry systems in water, electrical and processing industries. You will also have an excellent opportunity to network with your peers as well as to gain significant new information and techniques for your next radio telemetry project.
Module 18: Practical SCADA Systems for Industry

You Will Learn How to:

- The fundamentals of SCADA systems
- The essentials of SCADA software configuration
- Tricks and tips in installation of SCADA systems
- The essentials of SCADA telecommunications links
- The use of Industrial Ethernet in SCADA systems
- OPC and SCADA systems
- SCADA network security issues
- How to troubleshoot SCADA systems

Overview

SCADA has traditionally meant a window into the process of a plant or gathering of data from devices in the field, but now the focus is on integrating this process data into the actual business and using it in real time. The current emphasis is on using open communication protocols, such as IEC 60870, DNP3 and TCP/IP, and commercial off-the-shelf (COTS) hardware and software to keep the costs down. This module covers the fundamentals of SCADA design, installation and troubleshooting. It presents an excellent opportunity to network with your peers as well as gain significant new information and techniques for your next SCADA project.

THE PROGRAM

Topic 18.1

BACKGROUND TO SCADA

- Fundamentals and definition of terms
- Comparison of SCADA, DCS, PLC and Smart Instruments
- Typical SCADA installations

SCADA SYSTEMS HARDWARE

- Remote Terminal Unit (RTU) structure
- Analog and digital input/output modules
- Application programs
- Point-to-point and point-to-multipoint systems
- System reliability and availability
- Configuration of a master station

SCADA SYSTEMS SOFTWARE

- Design of SCADA software packages
- Configuration of SCADA systems
- Connecting to PLCs and other hardware
- SCADA system design
- The Twelve Golden Rules

HUMAN MACHINE INTERFACES (HMIs)

- Human and ergonomic factors
- HMI configuration
- Design and layout
- Alarming and reporting philosophies
- Alarm system design

GOOD INSTALLATION PRACTICE

- Recommended installation practice
- Ergonomic considerations

LANDLINE MEDIA

- Noise and interference on cables
- Twisted pair cables and fiber optic cables
- Public network services

Topic 18.2

WIDE AREA NETWORK (WAN) TECHNOLOGIES

- Digital hierarchies, T1 and E1
- Packet switching
- Frame Relay
- ATM
- SDH/Sonet

LOCAL AREA NETWORKS (LANs)

- Industrial Ethernet
- TCP/IP
- Bridges, routers and switches
- Redundancy options
- Wireless
- OPC

INDUSTRIAL COMMUNICATIONS PROTOCOLS

- RS-232
- RS-485
- Modbus
- DNP3.0

MODEMS

- Introduction and principles
- Modulation techniques
- Error detection and correction
- Troubleshooting

Topic 18.3

SCADA NETWORK SECURITY

- Authentication and encryption
- Firewalls

TROUBLESHOOTING AND MAINTENANCE

- Troubleshooting SCADA systems
- Maintenance tasks

SPECIFICATION OF SYSTEMS

- Common pitfalls
- Standards
- Performance criteria
- Testing
- Documentation

PROJECT MANAGEMENT OF SCADA SYSTEMS

- Phases of a SCADA project
- Specification of systems
- Implementation and commissioning
Module 19: Motor Protection, Control and Maintenance Technologies

You Will Learn How to:

- Specify protection requirements for motors
- Maintain electrical motors
- Specify speed control requirements for motors
- Understand essentials of motors and drives
- Detail the main issues with testing of motors
- Prevent or at least minimize motor bearing failure
- Troubleshoot and fix faults on motors and drives
- Interface control circuits of motors with PLCs/DCSs
- Reduce downtime on electrical motors
- Improve plant safety
- Improve plant throughput
- Reduce your spares usage and requirements

Overview

It is estimated that electrical drives and other rotating equipment consume about 50% of the total electrical energy consumed in the world today (and this figure increases to 70% if you only consider industry.) The cost of maintaining electrical motors can be a significant amount in the budget item of manufacturing and mining industries. This module will give you a thorough understanding of electrical motor’s protection, control and maintenance and provide you with the tools to maintain and troubleshoot electrical motors. You will gain a fundamental understanding of the protection, control and maintenance of electric motors and drives. Typical applications of electric motors in mining, manufacturing, materials handling and process control will be covered in detail. The concluding topic of the course will give you the fundamental tools in troubleshooting motors confidently and effectively.

Pre-Requisites

A fundamental knowledge of basic electrical concepts would be useful.

THE PROGRAM

Topic 19.1
INTRODUCTION
FUNDAMENTALS OF MOTOR TECHNOLOGY AND CONSTRUCTION
THREE PHASE AC INDUCTION MOTORS
ENERGY LOSSES AND EFFICIENCY OF THREE PHASE AC INDUCTION MOTORS

Topic 19.2
MOTOR FAILURE ANALYSIS
TESTING

Topic 19.3
BEARING FAILURE ANALYSIS
PROTECTION OF MOTORS
MOTOR CONTROL

Topic 19.4
CONTROL SYSTEM FOR AC VARIABLE SPEED DRIVES
INSTALLATION AND FAULT FINDING
NEW TECHNOLOGIES AND DEVELOPMENTS
SUMMARY, OPEN FORUM and CLOSING
Module 20: Practical Power Distribution for Engineers and Technicians

You Will Learn How to:

- Understand practical power distribution fundamentals
- Correctly implement the right type of switchgear for the appropriate application
- Economically select and install the best-suited power cable for a specific application
- Evaluate the need for power factor correction, and successfully implement correction strategies
- Implement successful maintenance strategies and procedures
- Effectively use software techniques to solve problem areas in your power network
- Determine short-circuit ratings quickly and effectively
- Assess the influence of fault levels on switchgear ratings
- Evaluate the advantages of modern state-of-the-art switchgear protection for your applications, including preventative maintenance information
- Recognize the different applications for various cable insulation types
- Correctly utilize and protect power transformers
- Assess and specify correct earthing throughout your electrical network
- Assess the economic justification for installing PFC equipment
- Correctly specify PFC equipment and be aware of practical consequences
- Confidently use software to solve and predict simple power network problems

Overview

These topics will focus on medium voltage (1 kV - 36 kV) power considerations, switchgear, power cables, transformers, power factor correction, earthing/grounding, lightning protection and network studies. You will gain technical know-how in these areas not covered by university or college programs.

Practical Design Sessions

Throughout the module you will perform practical design calculations to reinforce your understanding of each section.

Practical Demonstration

These will include how to use computer simulation software to design and/or troubleshoot your electrical power network - important practical issues in doing fault level calculations, load flow forecasts, motor starting studies and equipment sizing.

THE PROGRAM

Topic 20.1
INTRODUCTION
- Definition of power distribution
- Elements of a power distribution network
- Focus of workshop

FUNDAMENTALS OF POWER DISTRIBUTION
- Overview of basic electrical theory
- Basic design considerations
- Voltage considerations and improvement of voltage conditions
- Equipment generally used in power networks today

SHORT-CIRCUIT CURRENT CALCULATIONS
- Sources of fault current
- Fundamentals of short-circuit current calculations
- Assumptions and simplified calculations
- Restraints of simplified calculations
- Worked examples

Topic 20.2
MEDIUM VOLTAGE SWITCHGEAR
- Load currents and fault currents
- Switchgear capabilities and ratings
- Types of switchgear manufactured today and their applications
- Comparison of different types of insulation methods (air, oil, vacuum, SF6)
- Advantages and disadvantages of different types of medium voltage switchgear
- Internal arc proofing
- Modern protection relays used with switchgear
- Preventative maintenance
- Future trends

POWER CABLES
- Insulation types and their applications
- Cable losses and voltage drop
- Cable ratings and short-circuits
- Single core vs three core cables
- Cable installation
- Cable splicing and termination techniques

Topic 20.3
TRANSFORMERS
- Classifications
- Specifications
- Power transformers
- Connections and voltage taps
- Transformer impedance
- Insulation methods
- Cooling techniques
- Star-point earthing
- Accessories and protection

COMPENSATION AND POWER FACTOR CORRECTION
- Various capacitive and reactive compensation methods
- Overview of power factor theory
- Causes and effects of low power factor
- Methods to improve power factor and benefits
- Caution: capacitors with induction motors
- Transients and capacitor switching
- Resonance and harmonics
- Protection of capacitor banks
- Economic justification for power factor correction

Topic 20.4
EARNING
- System earthing
- Equipment earthing and earthing of structures
- Electrical safety earthing
- Static earthing
- Lightning protection
- Ground resistance measurement
- Factors influencing ground resistance

OVERVIEW OF COMPUTER SIMULATION SOFTWARE
- Load flow studies
- Fault level studies
- Equipment sizing
- Motor starting studies

LATEST DEVELOPMENTS IN TECHNOLOGY
- Automation of power distribution networks
- Digital instrument transformers
You Will Learn How to:

- Create quality project plans
- Generate effective work breakdown structures
- Create computerized PERT and Gantt charts for your projects, add and level resources and monitor/report on your project effectively
- Define appropriate cost reporting mechanisms for your projects
- Define, analyze and manage the risks associated with your projects
- Introduce appropriate Quality Management procedures
- Keep your projects on track using the Earned Value Analysis method
- Exercise an appropriate leadership style and keep team members creative and motivated
- Avoid the pitfalls caused by a lack of understanding of the legal issues pertaining to projects
- Use appropriate software to leverage your time and expertise
- Deal with projects that have a large degree of inherent uncertainty and/or a strong emphasis on timely completion

Overview

More and more engineering and technical professionals are making career transitions from product design into project management. This, however, requires formal training and a willingness to learn new skills. All the technical know-how in the world will not deliver a project successfully, i.e. with the required level of quality, within cost constraints and on time, without proper project management skills. Unfortunately very few engineering professionals have any degree of formal project management training, which results in a great deal of personal stress as well as cost blowouts and other woes, too often cited in the media. The lack of training often applies to the ‘people skills’ required for effectively leading the project team as well.

To address this problem, these topics will focus on the critical project related activities such as work breakdown, scheduling, cost control and risk management and show how these can be performed with software to lighten the project manager’s workload. The ‘soft’ [but equally important] aspects such as team leadership and contract law are also covered. All topics will be supplemented with practical exercises focusing primarily on the areas of electrical/electronic (including instrumentation) and mechanical engineering. If you wish to do so, you can choose [as a basis for the practical exercises], small projects from your work environment so that you are familiar with the attributes thereof.

THE PROGRAM

Topic 21.1

FUNDAMENTALS AND TIME MANAGEMENT
- Overview of the project environment
- Project life cycle and phases
- Project organizations
- Project success criteria and critical success factors
- Project planning
- Work Breakdown Structures
- Critical Path (Activity on Arrow) method of project network analysis
- Precedence (Activity on Node) method of project network analysis
- Presentation of project schedules (PERT/Gantt charts)
- Resource allocation, analysis and leveling
- Progress monitoring and reporting
- Project scheduling software selection

Topic 21.2

COST AND RISK MANAGEMENT
- Cost estimating methods and Forecast Final Cost
- Budgeting
- Financial control
- Change control
- Cost reporting and variance analysis
- Value management
- Risk management defined
- Risk identification
- Risk analysis methods
- Risk assessment, treatment and monitoring

Topic 21.3

QUALITY AND COST MANAGEMENT
- Defining quality and quality management
- Quality systems
- ISO 9000
- Project quality assurance
- Preparation of inspection and test plans
- Earned Value Management (EVM)
- Budgeted and actual costs (BCWP/BCWS/ACWP)
- Cost and schedule variances (CV/SV)
- Cost and schedule performance indices (CPI/SPI)
- Final project costs (ETC/EAC)

Topic 21.4

PROJECT TEAM MANAGEMENT AND CONTRACT LAW
- Management and leadership
- Leadership styles
- Situational leadership
- Organization and project team cultures
- Team spirit: motivating and hygienic factors
- Authority and power of the project manager
- Required attributes and essential functions of the project manager
- The legal system
- Essential elements of contracts
- Factors destroying the legal force of contracts
- Termination of contracts
- Breach of contracts
- Time extensions and liquidated damages