Advanced Diploma of Electrical Engineering for Practicing Engineers & Technicians

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

WHAT YOU WILL GAIN:
• Skills and know-how in the latest technologies in electrical engineering
• Practical guidance from electrical engineering experts in the field
• Knowledge from the extensive experience of the instructors, rather than from only the theoretical information gained from books and college
• Credibility as the local electrical engineering expert in your firm
• Networking contacts in the industry
• Improved career prospects and income
• An IDC Advanced Diploma of Electrical Engineering

Download the detailed prospectus here:
www.idc-online.com/e_learning/deeprospectus.pdf
INTRODUCTION

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

There is a great shortage of electrical engineers and technicians in every part of the world; due to retirement, restructuring and rapid growth in new industries and technologies. Many companies comment on how difficult it is to find experienced electrical professionals, despite paying outstanding salaries. About fifteen years ago significant shortages in the power industries developed the world over. These remain with specialists in this area being few and far between. The aim of this 18 month e-learning programme is to provide you with core electrical engineering skills so that these opportunities may be accessed, to enhance your career and to benefit your firm.

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

This practical course avoids weighty theory. This is rarely needed in the real world of industry where time is short and immediate results, based on hard-hitting and useful know-how, is a minimum requirement. The topics that will be covered are derived from the acclaimed IDC Technologies’ courses attended by over 200,000 engineers and technicians throughout the world during the past 16 years. And, due to the global nature of electric engineering today, you will be exposed to international standards.

This course is not intended as a substitute for a 4 or 5 year engineering degree or diploma, or for an accomplished and experienced professional electrical engineer who is working at the leading edge of electrical practice in these varied fields. It is however, intended to be the distillation of the key skills and know-how in practical, state-of-the-art electrical engineering. It should also be noted that learning is not only about attending courses; but also involves practical hands-on work with your peers, mentors, suppliers and clients.

IDC TECHNOLOGIES’ ACCREDITATION STATUS

IDC Technologies is an internationally endorsed Professional Training Organisation. It is very important to us at IDC Technologies to ensure that our clients can confidently attend our workshops knowing that the professional development they are receiving is of a creditable standard and will provide them with personal, measurable, productivity gains and the opportunity for career advancements.

We have presented courses to over 300,000 engineers and technicians over the past 16 years and our aim of maintaining the highest of standards has endured. IDC Technologies is a Registered Training Organisation (RTO) in Australia - National Provider Number – 51971.

To date IDC Technologies has received endorsement and/or validation from the following authorising bodies:

The Institution of Engineering and Technology, which has more than 150,000 members worldwide - the largest professional engineering society in Europe and the second largest of its type in the world.

The Institute of Measurement and Control in the United Kingdom, which is Britain’s foremost professional body for the Automation Industry.

IACET — This course is approved to provide you with 60 CEUs upon completion.

The Project Management Institute in the USA, which has more than 265,000 members in over 170 countries.

The Training Accreditation Council in Australia, which is the national leader in the strategic management of the recognition and quality assurance of training.

Engineers Australia, which is the national peak body for all engineering disciplines. It represents 80,000 members.

South Africa — IDC Technologies 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 recognised by ECSA (Engineering Council of South Africa). To view our list of validated workshops, visit ECSA's website www.ecsa.co.za and refer to the CPD Activities.

IEEE Education Partner — The IEEE is the world’s leading professional association for the advancement of technology, with more than 375,000 members in more than 160 countries.

If you need more information regarding the status of this Advanced Diploma please do not hesitate to contact the Course Coordinator through your local IDC office.

Benefits of E-learning

- Upgrade your skills and refresh your knowledge without having to travel or take valuable time off work
- Absorb information and materials in small, easy to digest sections
- Learn wherever you are - all you need is an Internet connection
- Receive constant support from your course instructor and coordinator for the duration of the course
- Interact and network with participants from around the globe and gain valuable insight into international practice
- Receive an IDC Advanced Diploma of Electrical Engineering for CPD purposes

Who Should Attend

- Electrical Engineers and Technicians
- Project Engineers
- Design Engineers
- Instrumentation and Design Engineers
- Electrical Technicians
- Field Technicians
- Electricians
- Plant Operators
- 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

In fact, anyone who wants to gain solid knowledge of the key elements of electrical engineering - to improve work skills and to create further job prospects. Even those of you who are highly experienced in electrical engineering may find it useful to attend some of the topics to gain key, up to date perspectives on electrical engineering.

Prior Learning Recognition and Exemptions

If you have existing knowledge and experience in a particular module we can give you credit for it. One of our staff will conduct a one-on-one interview with you to evaluate your knowledge. This will be done in a friendly and non-confrontational manner.
The course is composed of 15 modules. These cover the following seven main threads to provide you with maximum practical coverage in the field of electrical engineering:

- Electrical technology fundamentals
- Distribution equipment and protection
- Rotating machinery and transformers
- Power electronics
- Energy efficiency
- Earthing and safety regulations
- Operation and maintenance of electrical equipment

The 15 modules will be completed in the following order:

1) Basic electrical engineering - overview
2) Understanding electrical drawings
3) Electrical power distribution fundamentals
4) Circuit breakers and switchgear
5) Transformers
6) AC and DC machines
7) Power electronics and variable speed drives
8) Energy use and energy efficiency
9) Power cables and accessories
10) Earthing and lightning/surge protection
11) Power system protection
12) DC and AC emergency power supply equipment
13) Electrical safety and wiring regulations
14) Testing and troubleshooting of electrical equipment
15) Power quality fundamentals

For detailed information on the content and breakdown of modules, see pages 8 to 22

To register please contact idc@idc-online.com

Presentation Format

The programme features real-world applications and uses a multi-pronged approach involving interactive on-line webcasts, simulation software and self-study assignments with a mentor on call. The course consists of 70 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 receive 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 Webcasts

During the programme you will participate in 70 live interactive sessions/webcasts with the instructors and other participants from around the world. Each webcast will be scheduled twice, so that you can select the one which is most convenient to you. Webcast times are finalised after registrations close, as we need to be clear about all our participants’ time-zones before compiling a schedule. Upon registration you will receive a questionnaire regarding your time availability.

Hardware and Software Requirements

To register for the diploma all you need 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.

Practical Exercises and Remote Laboratories

As part of the groundbreaking new way of teaching, we will use a series of remote laboratories [labs] and simulation software. These will be used to facilitate your learning and to test the knowledge you gain during the course. They involve complete working labs, set up at various locations around the world, into which you will log and proceed through various practical sessions. These will be supplemented by simulation software, running either remotely or on your computer, to ensure you gain the requisite hands-on experience. Lectures teach little on their own so the labs and simulation software are designed to increase the absorption of the materials and to give you a practical orientation of the learning experience.

You will gain a solid, practical exposure to the key principles covered in the course which will ensure that you obtain maximum benefit from the course and succeed in your future career as an Electrical Engineer.
COMPREHENSIVE MANUALS AND ASSOCIATED DOCUMENTATION

You will receive 15 of our up-to-date technical manuals to add to your library. Together these texts contain over 4000 pages of valuable know-how distilled from years of experience in presenting these courses throughout the world.

1. Safe Operation and Maintenance of Circuit Breakers and Switchgear
2. Practical HV Cable Jointing and Terminations for Engineers and Technicians
3. Practical Energy Efficiency, Design, Engineering and Auditing
4. Maintenance and Troubleshooting of Uninterruptible Power Supply (UPS) Systems and Batteries
5. Practical Earthing/Grounding, Bonding, Lightning and Surge Protection
6. Practical Electrical Substation Safety
7. Electrical Drawings and Schematics
8. Practical Motor Protection, Control and Maintenance Technologies
10. Practical Power Distribution
11. Practical Power System Harmonics, Earthing and Power Quality - Problems and Solutions
12. Practical Power System Protection for Engineers and Technicians
13. Practical Power Transformers: Operation, Maintenance and Testing
14. Practical Variable Speed Drives for Instrumentation and Control Systems
15. Practical Shielding, EMC/EMI, Noise Reduction, Earthing and Circuit Board Layout

Please Note: Students who choose to pay upfront will receive all 15 manuals in advance. If you opt to pay by instalments you will receive manuals periodically throughout the course.

If you complete only selected topics you will receive only the relevant documentation.

Receive 15 up-to-date technical manuals
Over 5,000 pages of valuable know-how

Time Commitment for the Course

You will need to spend an estimated 6 hours per week. This includes the reading of the material prior to your attendance at each hour lecture (45 minutes with 15 minutes for discussion) and the time needed to complete assignments for submission. This 6 hours has been calculated to ensure the material is covered adequately and sufficient knowledge is gained to result in sound, enduring and immediately useful skills in Electrical Engineering.

Entrance Requirements

This IDC Technologies advanced diploma is an accelerated, practical, work-oriented course designed for those who have some background in the field. In order to maximise the benefit you will gain from this course, we would prefer you to have at least a tertiary qualification in engineering or IT (diploma or degree) and experience in engineering (preferably electrical). Practical work experience in related areas of engineering would also help enormously. It would not be suitable for a student with no relevant work experience.

These prerequisites would normally be necessary so that a student can comfortably complete the course in the 18-month time period. However, if you don't currently have an existing qualification and/or experience, please contact us for further supporting advice and career counselling. Most important, however, is a determination to persist and complete this course. We have various techniques to ensure that you feel part of a learning community and team.

We are Flexible with your Commitments

We recognise that personal circumstances can, on occasion, make it difficult to complete the course in the allocated time. We will guarantee you access to the resources for a period of 3 years, from the commencement of the course, to facilitate your achievement of the diploma.

You can also withdraw from the course at any time and still receive a Statement of Attainment for the modules you have completed. However, completion of all 15 modules will earn you the IDC Advanced Diploma of Electrical Engineering.

For more information or to register, please contact Sharne Pretorius at sharne@idc-online.com
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 Presenter**

**Windsor Coles**  
OBE, C Eng, FIEE

Windsor Coles has over 50 years experience in the Electrical Engineering industry with a solid grounding in circuit breakers and switchgear.

For over 25 years he acted as HM Senior Electrical Inspector in London and later in Wales, where he was responsible for the electrical and control systems safety matters in the region, and for the national oversight of electrical safety matters within the metals and quarrying sectors. During this time, he led investigations for the Health & Safety Executive, presenting evidence in both Civil and Criminal Courts.

Windsor currently focuses on consultancy, developing and presenting courses on Electrical Safety Standards and undertaking investigations into incidents involving electricity and machinery. He also develops and implements safety management systems for the electrical and process control sectors in both industrial and commercial sectors.

Windsor is an enthusiastic and experienced instructor, with a wealth of knowledge under his belt. He is passionate about transferring this knowledge in training courses and mentoring programmes.

**Programme Designer And Presenter**

**G.Vijayaraghavan**  
B.E. (Hons) Electrical

G.Vijayaraghavan is an electrical engineer with over 35 years experience in the Steel Industry and Engineering Consultancy.

He is the author of several of IDC’s technical books including Practical Earthing, Bonding, Shielding and Surge Protection which has been published and sold internationally by Elsevier(UK).

He regularly designs training workshops for IDC and lectures on their behalf to engineers and technicians world-wide.

He is a very knowledgeable instructor and his courses are extremely interesting with many ideas, anecdotes and tips drawn from his rich experience.

**Programme Designer**

**Steve Mackay**  
CP Eng, FIE (Aust), BSc(Elec Eng), BSc(Hons), MBA, MMR  
Technical Director, IDC Technologies

Steve has worked in engineering throughout Australia, Europe, Africa and North America for the past 30 years. He has presented numerous electrical engineering short courses world-wide to over 18,000 engineers and technicians, and has a particular interest in practical and leading edge aspects of marketing, business and engineering practice.

He is a fellow of Engineers Australia and the technical director and founder of IDC Technologies, IDC is a growing engineering training and publishing firm which has been operating from offices throughout the world since 1992. He has also acted as the author or editor of over 30 engineering textbooks sold throughout the world. He feels that all engineering businesses need to think global and to keep experimenting with new approaches. He is currently leading a team of two design engineers and four programmers in creating a new video conferencing software package with remote labs which he believes will make a marked impact on engineering training.

**Course Presenter**

**Jerry Walker**  
B.Tech

Jerry is one of those rare engineers who has worked all the way up from “the tools” as an electrical Millwright to achieving a doctorate in High Voltage and Diagnostic Engineering of Electrical Cable Insulation.

He commenced his career working on the Hot Strip Mill in a steel plant, on maintenance of protection systems and Variable Speed Drives, for 10 years. He then spent 9 years in the oil and gas industry where he was involved in the commissioning and maintenance of the complete spectrum of Power Electronic and Power Engineering equipment.

He has devoted the next fourteen years to a combination of research/consulting and lecturing, focusing on Power Distribution, Power Systems Protection and High Voltage Engineering. One of his major successes during that period has been the designing, equipping and commissioning of a complete high voltage laboratory for the engineering school of a prominent university where he is a professor in the Institute for High Voltage Studies. He is also a director of a consulting company focusing on high voltage testing and the supply of test equipment. He has presented hundreds of courses in electrical engineering topics throughout the world, including Africa, USA, Europe, Australia and Malaysia.

Jerry is a particularly entertaining instructor with a host of experiences in, and a tremendous passion for the topic of Electrical Power Cables and Insulation Systems.
International Expert Speaker Faculty

Course Presenter

Mike O’Rourke
B Eng CEng MIET

Mike has over 30 years experience as a building services engineer. His career includes Senior Electrical Design Engineer at Liverpool City Architect’s Department, Principal Engineer in Liverpool City Maintenance Department and Principal Building Services Engineer at Manchester Metropolitan University. He is now Technical Director of an Engineering Maintenance company Based in Chelmsford, Essex. He has also worked as an independent consultant, expert witness and trainer for many organizations including the IET.

He presents a practical approach to the subject supported by a thorough theoretical knowledge. An enthusiastic and positive instructor, you will find his presentations of excellent benefit in your work.

Course Presenter

Olof Bekker
Pr Eng, B.Sc (Elec Eng)

Olof has over 25 years of experience in the metal processing industries primarily as an Electrical Engineer, as well as considerable experience in the Mechanical, Electrical and Instrument fields. He has also over 17 Years Petrochemical experience in Engineering and Design. He has a particular interest in cathodic protection systems and has engineered many solutions mainly in the petrochemical industry. Olof currently acts as Manager of Electrical Engineering for Fluor, and has been recognized by Fluor as a subject matter expert. He has recently been nominated as a candidate for the prestigious Pacesetter Award.

An enthusiastic and entertaining instructor, he will draw on his experience to provide you with valuable know-how.

Course Presenter

Poritosh K. Shadhu Khan
PhD, M.Sc, MIEEE

After Poritosh obtained his Ph.D, he worked as a post doctoral fellow at Concordia University in Canada. He has been teaching both under and post graduate courses in electrical and electronic engineering for over 20 years for various universities in Asia and North America.

He has also conducted numerous training courses for practicing engineers in power system protection, operation, power electronics, electrical machine drives, electrical installation and electrical safety.

Poritosh is widely published in international journals and has guided many post graduate students in their research projects.

An enthusiastic instructor, he will transfer his know-how and skills across effectively.

Course Presenter

Emad Ibrahim
PhD, M.Sc

Professor Emad is a Senior Electrical and Power Engineer with over 30 years of experience in the design, installation, and execution of a wide range of electrical projects. He is currently a respected Professor with the Faculty of Engineering in Helwan University and has also lectured for prominent institutions such as the Arab Countries League, Bahrain Society of Engineers, the KSA Ministry of Electricity, King AbdulAziz University, University of Sharjah, and the University of Manchester (UK).

Previously, he has acted as Electro-Mechanical Coordinator, Electrical Superintendent and Consultant for various multinational companies, and has supervised multinational energy and power projects in Tanzania, Kenya, Ethiopia, Uganda, Sudan, and most of Eastern African Countries

Emad has gained prestigious fellowships with renowned institutions and organizations such as the Institution of Electrical Engineers (IET, formally the IEE), the Syndicate of Engineers, Syndicate of Educational Professions, Egyptian Society of Engineers Institution of Electrical & Electronic Engineers (IEEE) USA, and the American Association of Energy Engineers (AEE) USA.

Course Presenter

Ken McConachie
P.Eng, B.Sc (Elec Eng)

Ken’s ‘can-do’ approach has given him a wide range of engineering and interpersonal experience. He has a Bachelor of Science in Electrical Engineering and over 16 years of design, construction, and facility engineering. Ken also has 8 years experience as an Electronics Technician and in plant maintenance.

Currently, Ken is President of SS Engineering in Canada and is a successful Electrical and Controls Engineer. Throughout his career, Ken has worked at various industrial facilities such as oil pipelines, tank farms, oil sands plants, petrochemical plants, sour gas processing and industrial power transmission.

Ken’s proficiency and expertise in a variety of engineering disciplines include electrical systems [480V through to 144 kV], instrumentation, control systems, and communications architecture makes him a sought after and valuable instructor. You will walk away with the skills and knowledge that you can immediately apply to your workplace.
International Expert Speaker Faculty

Course Presenter

Piet Swart
Pr.Eng, D.Eng, FSAIEE

Piet Swart began his career working in the mining industry. He was appointed in various positions over a period of more than 25 years, beginning as tradesman and ending up as Resident Engineer in charge of all engineering operations of a large coal mine. He then made a major change midway during his working life to pursue an academic career after he obtained, in rapid succession, a B.Eng degree, a Masters and a Doctorate. Piet has been an active consultant to industry on Pulse Power, Pulse Corona Pollution control, DC arc furnace modeling and in Power Distribution, and assisted in the development of the associated IEEE Standards.

After 23 years in the academic world, Piet has now moved into doing a mix of consulting and short course lecturing. He is an Emeritus Professor in Electrical Engineering and a Fellow of the South African Institute of Electrical Engineers. His entertaining and enthusiastic presenting style makes him a much sought after instructor.

Course Presenter

Terry Cousins
BSc (Elec Eng)

Terry has a BSc Electrical Engineering as well as BComm and MBL degrees. Terry has over 30 years of experience in electrical power and distribution systems in various industries including the mining and steel sectors.

Terry is a director of Motswedi TLC Software which he co-founded in 1988. The company develops electrical engineering instrumentation and measurement solutions. Through leadership in his company R&D team, he has collaborated in the design and development of over 300 products including metering and power quality instruments. Terry has served on the South African National Standards committee for power quality instruments [SANS 1816]. As a senior member of the South African Institute of Electrical Engineers and a member of the IEEE, Terry has authored numerous papers on power distribution and power quality.

Course Presenter

Trevor Blackburn
PhD, MIEE, MIEEE CEng

Trevor has over thirty years experience in researching, teaching and consulting in the field of power system equipment, including circuit breakers, transformers and power cables. His main areas of expertise are in the insulation and operational aspects of these items of equipment and in the condition monitoring of high voltage equipment. He has had extensive involvement in CIGRE activities on both the local and international scenes and was the Australian representative on Study Committee 15/01 [Materials, diagnostics and emerging technology]. He is a member of a number of international working groups of CIGRE in the above areas. Although still actively involved in research, he is a consultant to the electrical supply industry and has published numerous papers.

In addition to his research activities he has organised and lectured in many seminars and courses for the electrical supply industry in the specific areas of electrical safety, partial discharges, condition monitoring, electrical instrumentation, building services and power system equipment. He has extensive experience in lecturing to industry and is an excellent and knowledgeable presenter with a strong grasp of the practical issues challenging the engineer and technician today. He has presented short courses extensively in Australia and South East Asia.

Course Presenter

Roger Royal
Dip EE (C&G) Grad.Dip Rob.

Roger has built up a solid 40 years of hard won experience in the electrical power industry and this is apparent in his instructing. He has a passion for teaching and has achieved outstanding results over the past ten years with his courses on circuit breakers & switchgear, earthing, bonding, lightning, surge protection, power systems protection and transformers throughout the world.

He commenced his career in the design and construction of transformers, power cables and switchgear with Alstom (GEC); this work included a significant degree of R&D. Roger has since worked for numerous blue chip companies in the classical design of power systems, transformers and switchgear. More recently, he has spent a considerable time in maintenance operations of electrical engineering assets.
Module 1: Basic Electrical Engineering Overview

You will learn the fundamental principles of:

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

Overview

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

Practical Sessions

Problems based on the application of facts learned in the module.

THE PROGRAM

Topic 1.1
- Electricity- A brief historical perspective
- Electrical insulators, conductors, semi-conductors and superconductors
- Electromagnetism
- Electrical measurements and applications in industry

Topic 1.2
- Electrical power generation, transmission, distribution and utilisation
- Electrical lighting and illumination engineering fundamentals

Topic 1.3
- Electrical heating in industry
- Power electronics and its applications in electrical engineering
- Embedded power generation in Industry
Module 2: Understanding Electrical Drawings

You will learn how to:

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

Overview

It is often said that drawing is the engineers' language for communicating effectively. Drawings are used to communicate and share information between different teams of engineers; the design engineer who conceptualizes equipment or an entire system, the production engineer who plans the steps in manufacturing the required components and subsystems, the assembly engineer who puts the components together, the testing engineer who tests the complete system, the installation engineer who installs the system or equipment and the maintenance engineer who is responsible for its upkeep.

A drawing should convey precise and identical information to all these engineers with diverse backgrounds and expertise. This calls for standardized methodologies, conventions and approach in preparing drawings. This module covers all these aspects with respect to engineering drawings in general and electrical drawings in particular. Various types of electrical drawings and their application, the steps in planning a drawing, selection of drawing size and scale, use of standardized symbols etc. are described in detail with commonly used examples from industry practice.

Practical Exercises

- Interpret the drawing of a typical circuit breaker schematic
- Exercise to represent the interlocking logic of a control schematic in PLC environment
- Planning and creating a drawing for motor control

THE PROGRAM

Topic 2.1
- Engineering drawing for electrical engineers - an introduction
- Components of a drawing, drawing sizes and scales
- Symbols used in electro technology and governing standards

Topic 2.2
- Single line and 3-line diagrams
- Schematic diagrams
- Cabling and wiring drawings
- Layout drawings

Topic 2.3
- Advances arising from computer aided drafting (CAD)
- Management of drawings
Module 3: Electrical Power Distribution Fundamentals

You will learn how to:

- Generate distribution system alternatives and evaluate the one best suited to your needs
- Plan an industrial power distribution network including embedded generation if necessary
- Do simple fault calculation for deciding equipment ratings
- Size equipment and cables used in a distribution system
- Select and use system study software
- Configure distribution automation systems

Overview

Power is a critical input to any industry and availability of uninterrupted, good quality power is essential for production. It is therefore necessary that an engineer regardless of his or her function must understand the basics of electrical power distribution. In this module we make an attempt to explain the methodology of power distribution in industrial plants in simple, easy-to-understand terms and discuss the important subsystems that go to make a complete distribution system.

No two industries are alike. The power requirement can vary from less than 100 kilowatts for small manufacturing units to several hundreds of megawatts in the case of large facilities such as an integrated steel plant or an aluminium smelter plant. Correspondingly, the complexities of power distribution systems within the facility may vary considerably. However, the basic governing principles are valid for all cases and will thus be very useful regardless of the type of industry in which you work.

Practical Exercises

- Fault level calculations
- Exercise in sizing of distribution equipment
- Cable sizing calculations

THE PROGRAM

Topic 3.1
- Overview

Topic 3.2
- Common distribution system alternatives

Topic 3.3
- Planning of power distribution system

Topic 3.4
- Fault level in electrical systems and their role in the choice of equipment

Topic 3.5
- Fault current evaluation of simple power distribution systems

Topic 3.6
- In-plant generation requirements and alternatives
- Distribution equipment sizing
- Power distribution system automation
- Maintenance and Asset management in distribution systems
Module 4: Circuit Breakers and Switchgear

You will learn how to:

- Distinguish between different types of circuit breakers and their operating principles
- Specify MV and LV circuit breakers
- Configure switchboards as per your requirements
- Ensure that how interlocks within a switchgear can prevent unsafe conditions in operation/maintenance

Overview

Electrical switchgear refers to the equipment used for receiving and distributing electric power to a group of loads. Circuit breakers form an important component in all electrical switchgear. It is the generic name for a class of electrical apparatus whose sole function is to open and close electric circuits in a power distribution system both during normal and fault conditions. Whenever there is a fault, circuit breakers switch the circuit off, so as to isolate the faulty portion of the power system quickly from the rest of the system. This usually occurs upon a trip signal generated by a protection relay. Circuit breaker and the switchgear in which they are housed come in a variety of configurations. This module discusses various types of LV and MV switchgear and how to specify, select, configure, install, operate and maintain them.

Practical Exercises

- Case studies involving circuit breaker failures and solutions
- Exercise on switchgear rating and switchgear room planning

THE PROGRAM

Topic 4.1
- Circuit breaker basics
- Function
- Historical development
- Difference between isolator and circuit breaker
- Principle of arc quenching
- Quenching media and their properties
- Current chopping in circuit breakers
- Major components
- Enclosures for indoor use and IP ratings
- HV Circuit breakers
- Common types of HV circuit breakers (BOCB, MOCB, ABCB and SF6 CB)
- Outdoor construction examples
- Operating principles of different type of CBs
- Different types of CB operating mechanisms (mechanical, hydraulic and pneumatic)
- Design features of operating mechanisms
- Comparative merits
- Maintenance aspects of HV circuit breakers

Topic 4.2
- MV Circuit breakers
- Common types of MV circuit breakers (BOCB, MOCB, ABCB and SF6 CB)
- Construction examples
- Operating principles of different type of CBs
- Different types of CB operating mechanisms (Manual, spring charged, solenoid operated)
- Design features of operating mechanisms
- Comparative merits
- Maintenance aspects of MV circuit breakers
- LV Circuit breakers
- Common types of LV circuit breakers (ACB, MCB, Motor CB and Miniature CB)
- Construction examples
- Operating principles of different type of CBs
- Different types of CB operating mechanisms (Manual, spring charged stored energy)
- Maintenance aspects of LV circuit breakers

Topic 4.3
- HV Switchgear
- MV Distribution switchgear

Topic 4.4
- LV switchgear
- Selection of circuit breakers and switchgear, their Ratings and Specifications
Module 5: Transformers

What you will learn:

• Basic principles of transformers
• Configurations of transformers and vector group
• Off circuit and on load tap changers
• Cooling of transformers
• Dry type and VPI type construction
• Specifying a transformer
• Maintaining a transformer
• Failure prevention
• Residual life estimation

Overview

In today’s world, the bulk of electrical power is generated in the form of AC using generators whether thermal, hydro, nuclear or gas. However due to equipment sizing, insulation requirements, etc., the generating voltage in the present day power stations is limited in the order of 15 to 25 kV though the power generated is in hundreds of megawatts. It is impractical to distribute this much power at the generated voltage due to the magnitudes of currents, which are in the order of about 1000 ampere for every 25 MVA at 15 kV.

A transformer is the answer to the above issues and today’s AC distribution cannot be what it is without the use of transformers. Transformers therefore form the single most critical asset in any power distribution system and a thorough knowledge about the principles of their construction, operation and maintenance is an absolute must for any electrical engineer.

Practical Exercises

• Numerical exercises on basic transformer parameters, parallel operation and cyclic loading
• Framing a predictive maintenance procedure for a 50 MVA power transformer

THE PROGRAM

Topic 5.1
• Transformer theory
• Transformer connections and markings

Topic 5.2
• Transformer construction
• Transformer types

Topic 5.3
• Testing of transformers
• Transformer installation

Topic 5.4
• Transformer operation and maintenance
• Transformer protection
• Transformer failures
Module 6: AC and DC Machines

What you will learn:

- Basic principles of DC machines and AC machines
- Construction of AC and DC machines
- Speed control principles
- Reversing and braking principles
- Losses and efficiency and measurements
- Testing of machines
- Maintenance aspects
- Troubleshooting
- Protection of motors
- New developments in motor technology

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 consider only industrial loads). Though DC machines were the first to be developed, the use of AC motors has become substantially higher with the growth of AC power distribution. DC motors find applications in selected and niche areas only mainly due to their higher maintenance requirements. Though originally DC machines offered the sole choice when high torque and speed control were required by an application, the advancements in power electronics has resulted in a new generation of drives offering torque and speed control over a large range.

The cost of maintaining electrical motors can be a significant amount in the budget item of manufacturing and mining industries. This module gives you a thorough understanding of electrical motor protection, control and maintenance and gives you the tools to maintain and troubleshoot electrical motors. The concluding section gives you the fundamental tools in troubleshooting motors confidently and effectively.

Practical Exercises

- Numerical problems related to motors

THE PROGRAM

Topic 6.1

- Electrical machines-Basic principles
- DC machines

Topic 6.2

- AC machines-Basic principles
- Constructional aspects of 3-phase induction machines
- Energy Losses and efficiency of 3-phase AC Induction Motors and their measurement
- Protection of Motors

Topic 6.3

- Motor Control
- Motor Failure Analysis
- Bearing Failure Analysis

Topic 6.4

- Testing of motors
- New Technologies and Developments
Module 7: Power Electronics and Variable Speed Drives (VSD)

What you will learn:

- Basics of power electronics and devices used in power electronic equipment
- Designing/sizing of SMPS and their components
- Variable speed drives for motor speed control and their applications
- Control and protection of VSD
- Electro-magnetic compatibility issues
- Troubleshooting of VSD equipment

Overview

Power electronic circuits have revolutionised almost every device that we use today from PCs to TV’s, microwave ovens and heavy industrial drives. Switch Mode Power Supplies (SMPS) and Variable Speed Drives (VSD) have thus become an important part of equipment design in all types of industrial equipment and an understanding of the different types and designs has become essential for reliable operation of complex equipment. Variable speed drive technology is a cost effective method to match driver speed to load demands and is an excellent opportunity to reduce operating costs and improve overall efficiencies in your application.

This module gives you a fundamental understanding of the basic components that form a SMPS design and the installation, operation and troubleshooting of variable speed drives. You will understand how the selection of components affects the different performance parameters and operation of the SMPS. Typical practical applications of VSDs in process control and materials handling, such as those for pumping, ventilation, conveyers, compressors and hoists are covered in detail. It also covers the basic setup of parameters, control wiring and safety precautions in installing a VSD. The various drive features such as operating modes, braking types, automatic restart and many others are discussed in detail. The module covers the four basic requirements for a VSD to function properly with emphasis on typical controller faults, their causes and how they can be repaired. Even though the focus is on the direct application of this technology, you will gain a thorough understanding of the problems that can be introduced by SMPSs and VSDs such as ripple, harmonics, electrostatic discharge and EMC/EMI problems.

THE PROGRAM

Topic 7.1
- Introduction to Power Electronic Circuits and Devices
- Introduction to Switch Mode Power Supplies

Topic 7.2
- Switch Mode Power Supply Design-Part 1
- Switch Mode Power Supply Design-Part 2
- Switch Mode Power Control and Stability

Topic 7.3
- Introduction to Variable Speed Drives
- 3-Phase Induction Motors

Topic 7.4
- Protection of Drives
- Control System for AC Variable Speed Drives

Topic 7.5
- Selection of AC Converters for Variable Speed Drives Applications
- Electromagnetic Compatibility (EMC)
- Installation and Fault Finding Techniques

Practical Exercises
- Case studies of VSD applications and exercises involving selection of drives for typical motor applications
Module 8: Energy Use and Energy Efficiency

You will learn how to:

- Establish an Energy Saving Strategy for your organization
- Put together practical energy efficiency plans for your firm that will save money
- Improve employee working conditions and productivity with minimal outlay
- Use the energy savings toolkit and checklist from the course in your workplace
- Assist in the reduction of greenhouse gases and improvement of the environment
- Apply proven key principles of energy savings techniques with minimal investment
- Readily conduct a simple energy audit of your workplace and collect good data
- Read and interpret data from different types of measurement equipment
- Look for opportunities to set demand-side energy management strategies
- Appreciate the importance to your organization of choices with energy suppliers
- Interpret and analyse case study data and relate this detail to your facility

Overview

Reducing the energy costs at one's facility must surely be one of the most effective and achievable strategies for lowering operating costs. This section gives you the practical tools to identify and implement programs and projects to reduce energy consumption in the most effective and practical ways.

You will be greatly surprised at the levels of energy losses and poor efficiency of some of the devices in your facility that consume power when the facility is operational and also the energy consumption of your facility when it is not operational. Did you know that a typical microwave oven consumes more electricity power in the digital clock than it does heating food? Both of these factors impose a huge cost on your organisation, considering that energy bills are generally at least 20% of the running costs of a business. So reductions in these bills can directly lead to better profits.

This module covers fundamental principles of energy efficiency by way of looking for points of wastage, assessment of the cost of energy usage and benefits accruing from improved energy efficiency in the facility. This section also discusses how to quickly and effectively perform an energy audit of your facility, demonstrating the use of installed instrumentation as well as measuring equipment deployed during the audit.
Module 9: Power Cables and Accessories

What you will learn:

- Various types of cables available and their comparative merits
- Selecting the right type of cable
- Cable sizing and derating according to the site conditions
- Accessories for joints and terminations
- Correct procedures for jointing and termination and how to avoid weaknesses
- Failure modes in cables and avoiding failures
- Testing of cable systems and location of faults

Overview

Cables are one of the most expensive assets in a power distribution network. Technical staff need to have expert knowledge in selection, application, installation and tools available for fault location combined with experience in order to achieve outstanding service reliability. This module is designed to ensure that those responsible for the selection, laying, operation, maintenance and monitoring of power cables understand the technical issues involved and comply with relevant specifications and requirements.

Termination and joints are the usual weak areas in any cable system and most electrical failures take place due to improperly executed joints and terminations. Faults in underground cables cause loss of supply to customers and loss of revenue for electricity suppliers. It is imperative that the fault location process is efficient and accurate to minimise excavation time, which results in reducing the inconvenience to all concerned. This covers these accessories in detail and discusses the reasons of failures so that the participant gains a good knowledge of incorrect practices and their impact on cable reliability.

Practical Exercises

- Numerical problems relating to cable sizing and pull tension control
- Designing cable support system in a cable vault based on stated constraints

THE PROGRAM

Topic 9.1
- Introduction
- Basic theory

Topic 9.2
- Selection of cables and installation

Topic 9.3
- Joints and termination
- Jointing and termination practice

Topic 9.4
- Commissioning and periodic testing
- Failure modes and fault detection
- New trends in cable technology
Module 10: **Earthing and Lightning /Surge Protection**

**You will learn how to:**

- Apply the various methods of earthing electrical systems
- Detail the applicable national Standards
- Describe the purposes of earthing and bonding
- List the types of systems that cannot be earthed
- Correctly shield sensitive communications cables from noise and interference
- Apply practical knowledge of surge and transient protection
- Troubleshoot and fix earthing and surge problems
- Design, install and test an effective earthing system for electronic equipment
- Understand lightning and how to minimize its impact on your facility
- Protect sensitive equipment from lightning

**Overview**

Few topics generate as much controversy and argument as that of earthing and the associated topics of surge protection, shielding and lightning protection of electrical and electronic systems. Poor earthing practice can be the cause of continual and intermittent difficult-to-diagnose problems in a facility. This module looks at these issues from a fresh yet practical perspective and enables you to reduce expensive downtime on your plant and equipment to a minimum by correct application of these principles.

This is designed to demystify the subject of earthing and presents the subject in a clear, straightforward manner. Installation, testing and inspection procedures for industrial and commercial power systems are examined in detail. Essentially this module is broken down into earthing, shielding and surge protection for both power and electronics systems. Earthing and surge protection for telecommunications and IT systems are examined in detail. Finally, the impact of lightning and simple techniques for minimizing its impact are discussed.

**Practical Exercises**

- Numerical exercises on earthing electrode and conductor parameters
- Spreadsheet based evaluation of lightning protection requirements
Module 11: Power System Protection

What you will learn:

- Fundamentals of electrical power protection and applications
- Protection system components
- Relay settings
- Unit protection systems
- Different types of protection systems specific to equipment (transformers, lines, machines etc.)

Overview

This module has been designed to give a better appreciation of the role played by power system protection systems. An understanding of power systems along with correct management, will increase your plant efficiency and performance as well as increasing safety for all concerned. Any power system is prone to faults' (also called short-circuits), which occur mostly as a result of insulation failure and sometimes due to external causes. The high current resulting from a fault can stress the electrical conductors and connected equipment thermally and electrodynamically. Arcs at the fault point can cause dangerous or even fatal burn injuries to operating and maintenance workers in the vicinity.

The module aims to provide excellent understanding on both a theoretical and practical level. It starts at a basic level so as to serve as a refresher to those who are more familiar with the basic topics covered and then moves onto more detailed applications. It gives an introduction covering the need for protection, fault types and their effects, and how system earthing affects protection design. The module also includes some practical work, simple to complex fault calculations, relay settings and how to interpret a current transformer magnetisation curve.

This module will provide you with the skills and knowledge necessary to calculate fault currents, select relays and associated instrument transformers appropriate to each typical system or equipment. Other topics covered include unit, transformer, generator and motor protection.

Practical Exercises

- Fault calculations, relay settings and how to interpret a current transformer magnetisation curve.
- Software based exercises in relay coordination
Module 12: DC and AC High Reliability Power Supplies

You will learn how to:

- Plan a power supply system for high-reliability installations
- Describe the basic building blocks of UPS systems
- List typical power quality problems
- Detail the operation of the popular UPS systems
- Maintain and test lead acid and nickel cadmium batteries
- Apply safe working practice for UPSs and batteries

Overview

Power is fast becoming a commodity that cannot be taken for granted. The reasons differ from country to country. It may be due to resource scarcity or uneconomical fuels. It can be aging equipment, which is not replaced due to capital constraints; or it may be simply that the interconnected power system has become so complex that its reliable operation has become uncertain. On the other hand, our dependence on electricity is growing and even a few hours of power disruption has become unthinkable. An unscheduled interruption can cause immense damage besides accidents and loss of life. While it is impossible to guarantee 100% availability of power at all points in any system, vulnerable sections can be provided with emergency power alternatives to ensure more reliable power, thereby avoiding the problems of power interruption. This module teaches you the basic facts about ensuring reliable power supply to critical systems using various available options.

Practical Exercises

- Battery sizing calculations for DC and AC emergency power requirements

THE PROGRAM

Topic 12.1
- Critical power needs and solutions
- Critical power supply options

Topic 12.2
- Configuring power distribution system for critical loads
- A refresher on semiconductors, rectifiers and inverters

Topic 12.3
- Static UPS systems
- Static Transfer systems for critical power supplies

Topic 12.4
- Basics of Batteries
- Charging and discharging of batteries

Topic 12.5
- Selection and sizing of batteries

Topic 12.6
- Installation of batteries
- Battery maintenance, battery failures and disposal
Module 13: Electrical Safety and Wiring Regulations

You will learn to:

- Identify the hazards in operating and carrying out maintenance work in different parts of electrical substations and other installations including batteries used in emergency power supply systems.
- Identify the various statutory or legal regulations/acts dealing with electrical safety at work and the responsibilities of employer and employee in ensuring safe work practices.
- Appreciate the basic theoretical aspects involved in electrical safety and the relevance of safety systems and appliances commonly used at work.
- Understand the importance of proper design of electrical equipment and their selection in a given installation in ensuring safety.
- Gain a clear understanding of the procedures/practices adopted for safe working in different parts of electrical installations including outdoor switchyards.
- Appreciate the role of regular periodic inspection and planned/condition-based maintenance in ensuring safe operation of electrical equipment.
- Gain an insight into the organisational aspects of safety, the procedures adopted for reporting of accidents, carrying out investigations and arriving at appropriate measures to improve safety and prevent accidents.

Overview

Safety in general, and electrical safety in particular are subjects of various legislative and statutory provisions in every country/state in the world. Electrical accidents take a heavy toll every year in terms of loss of human life, financial liabilities due to death or injuries, loss of industrial output and so on. The interesting part is that most accidents need not happen at all, if everyone concerned complies with the safety enactments and safety codes. In other words, electrical accidents are mostly avoidable. The fact that accidents continue to happen simply means that we have not fulfilled the goal of creating and sustaining a climate of safety awareness among the employers and the workforce. To understand the underlying concern behind any safety regulation, one must be able to appreciate the common principles and physical laws on which the regulations are based. The module explains the theoretical as well as the practical principles behind electrical safety. The legal framework for occupational and electrical safety is also explained by covering the broad structure of the rules or regulations applicable in different countries.

THE PROGRAM

**Topic 13.1**
- An Introduction to Electrical Safety
- Role of protective earthing in electrical safety

**Topic 13.2**
- Hazards Due to Electrical Arcing and Heating-1
- Hazards Due to Electrical Arcing and Heating-2

**Topic 13.3**
- Safety Aspect in Electrical Design and Selection
- Safe Operation and Maintenance

**Topic 13.4**
- Substation Safety
- Safety in Battery Installations

**Topic 13.5**
- Organizational Aspects Of Safety
- Australian regulations on safety

Practical Sessions

Problems based on the application of facts learned in the module.
Module 14: Testing, Troubleshooting and Maintenance of Electrical Equipment

What you will learn:

- Types of HV & MV tests performed
- Good industry practice in performing the tests
- The need for testing of MV and HV electrical equipment
- Various types of HV equipment encountered in industry
- Stage wise testing performed on electrical equipment
- Testing equipment used
- Need for good record keeping on tests conducted
- Role of standards on testing approach, test basis and interpretation of results
- National test labs and their importance in quality assurance

Overview

Testing is an essential activity in any engineer’s career. Whatever your role in industry - electrical designer, purchase engineer, manufacturer, installation contractor or maintenance engineer - a solid knowledge of tests to be carried out on a given piece of electrical equipment and interpretation of results obtained is a necessity. This module is designed to familiarise you with various aspects of testing general electrical equipment.

Examples are cited from various international standards regarding the procedure for conducting of tests and interpreting the test results. The need for keeping proper records of tests conducted both in the initial stages and later during routine maintenance is discussed. Some of the tests are too complex to be performed on a routine basis or may require specialised equipment which may not be normally available to user industries or even manufacturers. This is where the services of an independent and accredited test lab is useful. The role of such labs is briefly discussed.

Practical Sessions

- Study of a typical CT Analyzer (test equipment)
- Developing a system for storing the records of MV current transformers tests using a CT analyzer in a substation
- Developing a plan for forming a testing group in a large industrial plant and the organization and facilities requirement

Topic 14.1
- Fundamentals of testing
- Role of insulation in electrical equipment
- Insulation testing

Topic 14.2
- High potential tests
- Oil testing
- TAN Delta Testing

Topic 14.3
- Partial Discharge (PD) Testing
- Impulse testing
- Measuring of low resistances as part of testing

Topic 14.4
- Transformer testing
- Cable testing during operation and fault detection
- Testing of Alternators during maintenance
- Testing of other HV equipment
- Documentation of testing
- Organisational aspects of testing

Topic 14.5
- Maintenance of electrical equipment
You will learn how to:

- Develop a sound working knowledge of earthing and harmonics
- Protect equipment from surge and transient protection
- Design electrical and electronic systems correctly by applying knowledge of harmonics and earthing principles
- Describe applications for the latest technologies in correcting earthing, harmonics, surge, and transient problems
- Troubleshoot electrical and electronic system problems arising from poor power quality
- Isolate and rectify power quality problems

Overview

Inadequate power quality is one of the main reasons for unsatisfactory operation and failure of electrical equipment. In this module, you will learn what is meant by power quality and the factors that make the power quality less than perfect. It covers the various parameters that determine power quality, the impact of these parameters when they go beyond specified limits. The module also discusses the different aspects of power quality and measures to be adopted to mitigate the effects of poor power quality.

A reasonable definition of quality power can be: Power made available at stipulated voltage and frequency without distortion of waveform or loss of symmetry and with minimum instances/duration of variations beyond the specified limits or unscheduled interruptions. From this definition, a few aspects would be clear. The first is that it is generally accepted that any electrical parameter cannot remain absolutely constant and some variations will occur. So also, an unscheduled interruption is a possibility that has to be anticipated. What is therefore possible is to accept the inevitable and plan for it. The measures adopted for mitigation should depend upon the sensitivity of the connected equipment to the disturbances and the demands of the process which is being supplied by a power system.

Practical Sessions

- Ten numerical problems using software applications ABC012 and HASIP
- Providing suggested solutions to eight practical cases of power quality problems

THE PROGRAM

Topic 15.1
- Power quality overview
- Dealing with power interruptions
- Voltage variations
- Surges and surge protection/Electrical noise

Topic 15.2
- Voltage asymmetry
- Harmonics in power systems

Topic 15.3
- System planning and installation guidelines
- Survey of power quality problems and solutions
- Power quality site study
- Power quality from a Utility perspective