



Advanced Diploma of
**APPLIED ELECTRICAL
ENGINEERING**
for Practicing Engineers
and Technicians**



COMMENCEMENT DATE:

For upcoming commencement dates, please view our course schedule at:
<http://www.eit.edu.au/schedule>

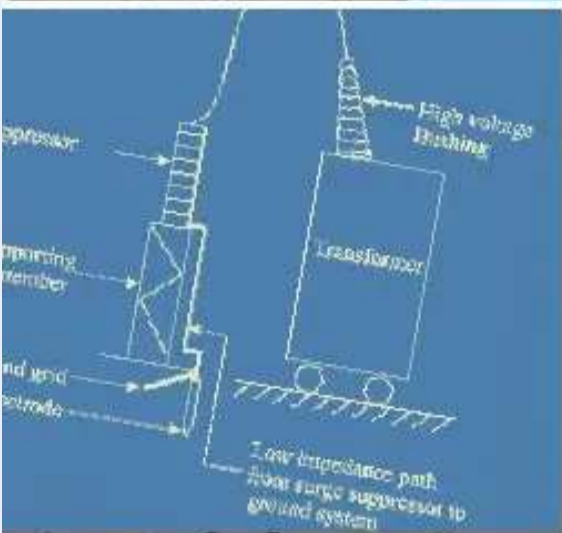
Remain at the cutting edge of electrical engineering
Participate from your home and office
through innovative, live e-learning
Learn from world renowned experts
in electrical engineering
Join the next generation of electrical engineers

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 EIT Advanced Diploma of Applied Electrical Engineering

Visit our website: www.eit.edu.au

** A note regarding recognition of this course in the Australian education system: The EIT is the owner of this course. The course is officially accredited within the Australian Qualifications Framework by the Training Accreditation Council, and is approved by the Australian Skills Quality Authority (ASQA) for delivery by the EIT in all Australian states. The EIT delivers this course to students worldwide.



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 300,000 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.



"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

"This is ideal for people such as myself that don't live or work in a city environment. It is the only viable way of increasing knowledge whilst working full time on a fly-in-out roster pattern."

Brett Lapham

"When you are in a particular field and profession for a long time you rather think you know it all. This course has made me realize that there are new things to learn every day especially with the ever changing technology. "

Stephen Dzveya

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 enrolment 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 cancellation or postponement of IDC Technologies workshops and conferences. Other conditions may apply at our discretion.

EIT Accreditation Status

The Engineering Institute of Technology (EIT) is an institute for higher learning. It has emerged from its founding organisation, 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 authorising 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 375,000 members in more than 160 countries. The EIT is an IEEE Continuing Education Provider.

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

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

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 recognised 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 advanced diploma 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) in South Africa's educational system. However, in most cases formal individual recognition by SAQA is not required as the international validity and accreditation of this credential is very sound.

Asia Pacific Utilities Group Supplier Management System

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

AQF - The Australian Qualifications Framework (AQF) is the national policy for regulated qualifications in Australian education and training. The Advanced Diploma of Applied Electrical Engineering is an AQF accredited qualification.

For additional information please see <http://www.eit.edu.au/international-standing>.



To enrol please contact eit@eit.edu.au

COURSE STRUCTURE

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 10 to 24

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.

Presentation Format

The programme 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 programme you will participate in 72 live interactive sessions/webinars with the instructors and other participants from around the

world. Each webcast will be scheduled at two varying session times, so that you can select the one which is most convenient to you. Webinar times are only finalised 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.

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

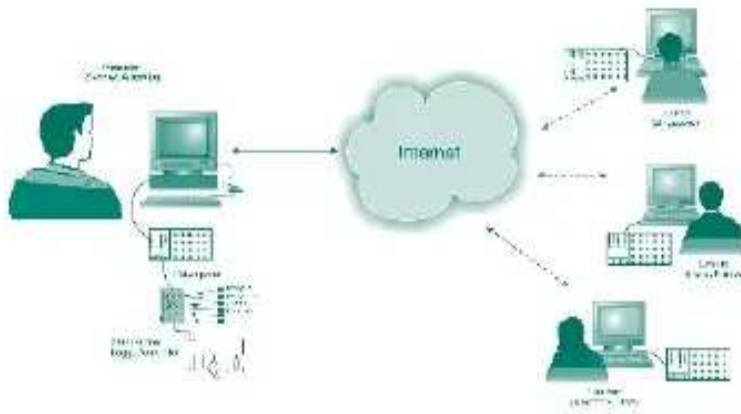
course and ensure you are able to put theory into practice.

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.



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 accredited EIT Advanced Diploma of Applied Electrical Engineering for CPD purposes

About the Engineering Institute of Technology (EIT)

The key objective of the Engineering Institute of Technology (EIT) is to provide an outstanding practical engineering and technology education; at Diploma level and beyond. The finest engineering lecturers and instructors, with extensive real engineering experience in industry, are employed from around the world. The learning is enhanced through live, two-way, online (e-learning) technologies. The EIT offers certificates and diplomas in a growing array of engineering fields. Many (perhaps, most) engineering faculties in universities and colleges experience a significant challenge delivering the 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.

The EIT is a sister company of the well known and reputable engineering training organisation, IDC Technologies. IDC has been operating for over 20 years, from offices throughout the world, delivering practical short courses to well over 300,000 engineers and technicians.

For more information or to register,
please contact us at enquiries@eit.edu.au

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 practising professionals giving hard-hitting practical know-how relevant to today's market and is aimed at people working in industry. We design and select Case Studies and practical exercises in the 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.



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 8000 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. 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
9. Wind and Solar Power - Renewable Energy 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
16. Setting Up, Understanding and Troubleshooting of Industrial Ethernet and Automation Networks
17. Practical Fibre Optics for Engineers and Technicians
18. Practical Fundamentals of Telecommunications and Wireless Communications
19. Practical Arc Flash Protection for Electrical Safety Professionals
20. Critical Power Supply Options and Planning of High Availability Supplies
21. Operation and Maintenance of Diesel Power Generating Plants
22. Troubleshooting, Maintenance and Protection of AC Electrical Motors and Drives
23. Electrical Maintenance for Engineers and Technicians
24. Practical Industrial Electronics for Engineers and Technicians
25. Practical Programmable Logic Controllers (PLCs) for Automation and Process Control
26. Practical Hazardous Areas for Engineers and Technicians
27. Practical Instrumentation for Automation and Process Control
28. Gas Turbines: Fundamentals, Maintenance, Inspection & Troubleshooting
29. Practical Financial Fundamentals and Project Investment Decision Making
30. Engineering Leadership - Making the Transition from Engineer to Leader



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 advanced diploma 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 formalise and enhance their achievements, and those with higher level qualifications in a related field who wish to develop specialist knowledge. Practical work experience in related areas of engineering would help enormously. It would not be suitable for a student with no relevant work experience. We will review your enrolment application and may recommend pre-course studies if required.

Advanced Diploma 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 Advanced Diploma 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 recognise 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 Advanced Diploma of Applied Electrical Engineering.



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 targeted."
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 recognised qualifications on completion."
Netafim

"I took a previous course, IDC [associated organisation] is professional." Cat Group

"I have done other courses with IDC {associated organisation} 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."
Powerco, New Zealand

"Better choice of topic." Rockwell RA

"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 pdyment."
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 recognised 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.



Contact us!

For any other enquiries, please contact us at enquiries@eit.edu.au

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 enrol you will receive a questionnaire which will help us determine your availability. When all questionnaires are returned we create a schedule which will endeavour 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 advanced diploma course is delivered over an intensive 18 months. We do break for about 4 weeks per year for traditional festive seasons.

Contact us! For any other enquiries, please contact us at enquiries@eit.edu.au

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 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.



Program 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.



Course Presenter

George Marx Pr Eng, B Sc (Eng) Senior Engineer

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

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



Course Presenter

Andre du Plessis Grad. Dip. Elect. Eng.
Heavy Current., Elect & Mech Cert of Comp Mines

Andre has over 30 years experience in Electrical and Mechanical engineering in the mining industry, mainly underground and surface operations for gold, coal and platinum mines. Andre worked on various in-house projects and problem solving, in plants and smelting furnaces, including materials handling, battery locos and overhead trolley lines.

He has also had experience in maintaining and upgrading sub-stations, power distribution to concentrator plants, furnace, and mine sites. Some of his more notable projects were the installation of new 6.6kV cables down vertical winding shafts on gold mines and upgrading the OCBs to VCBs and doubling the capacity of Transforms for two 42MW furnaces for Anglo American mines in South Africa. Andre is a knowledgeable presenter with hands-on experience in a range of industries, which he is eager to share.



International Expert Speaker Faculty

Course Presenter

Jerry Walker D.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.



Course Presenter

Trevor Blackburn PhD, MIET, 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/D1 (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

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

Arthur Bithell

Arthur has over 25 years of hands-on experience in the electrical industry, which he is eager to share. Over the last three decades he has designed, manufactured, installed and serviced commercial air conditioning power and control systems including programming of building automation/management systems (DDC). He has commissioned air conditioning systems including air and water balancing, and developed a hybrid PID control loop designed to overcome some inherent PID inefficiencies and increase output stability. Arthur has also designed the control system hardware, programming and PC graphics for a fully automated grey/

rain water system using his own soil moisture sensors showcased on a popular Australian documentary series. He has a keen interest in renewable energy and been involved in the design and development of air, water and hydraulic power and control systems.

Arthur has become well known as an expert in the field and loves the challenge of troubleshooting and fault-finding complex systems. He is frequently approached for technical assistance and support in new systems and existing installations and has provided on-the-job training for staff in controls and fault finding. He currently runs his own company importing, designing manufacturing and distributing electrical/electronic sensors and controls and assists in troubleshooting problem air conditioning systems in large installations.



Module 1: Basic Electrical Engineering Overview

You will learn the fundamental principles of:

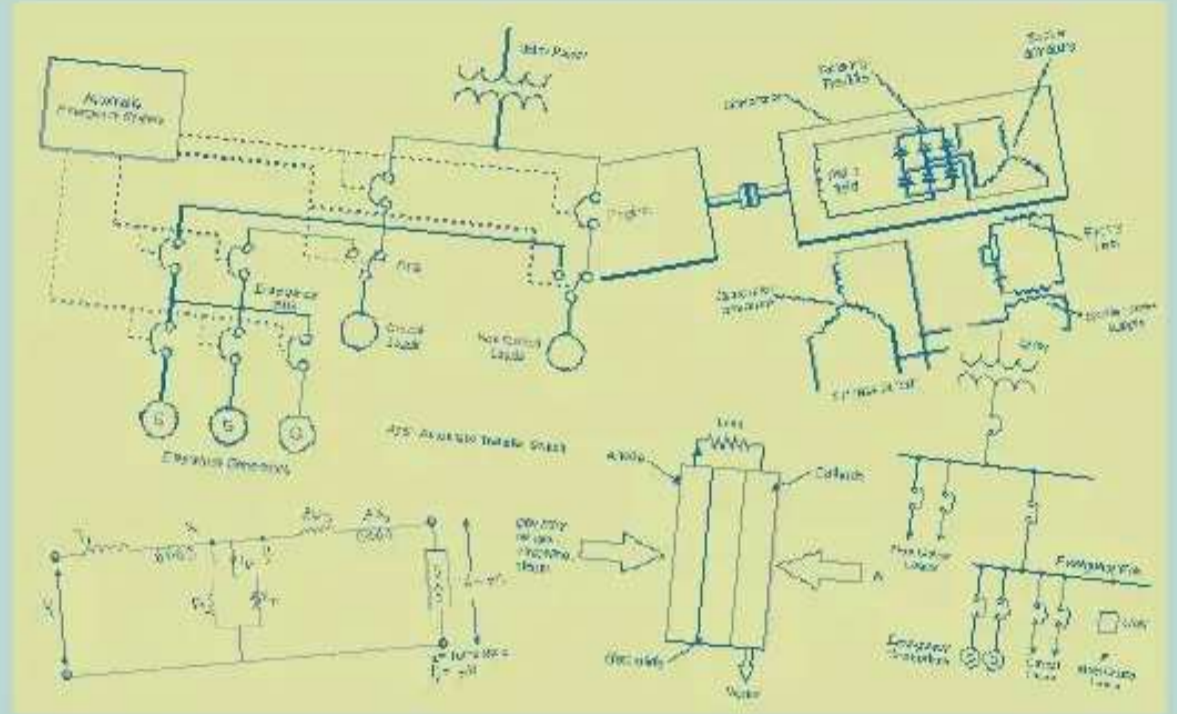
- The development and growth of electrical engineering
- Electrical conductors, insulators, semi and superconductors
- Electricity and magnetism
- Power distribution equipment
- Power utilization equipment
- Power quality
- Electrical safety

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.

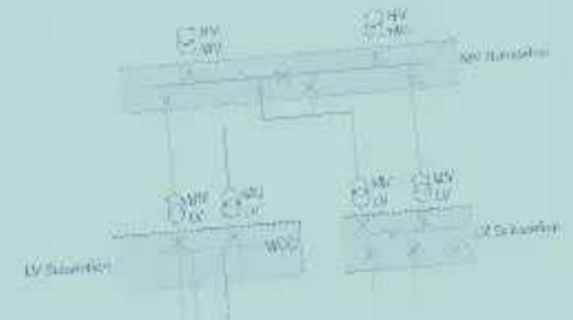


THE PROGRAM

Topic 1.1

Fundamentals of electricity

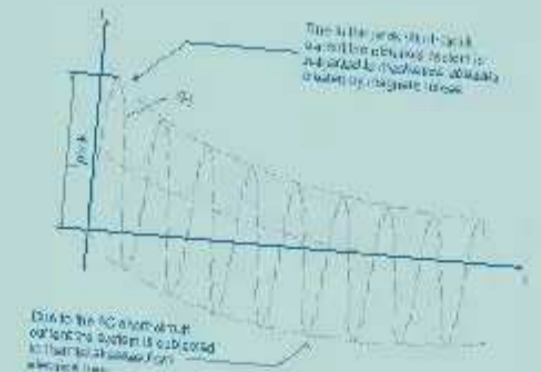
- Forms of electricity
- Electricity sources
- Conductors, insulators, semiconductors and superconductors
- Basic electrical theory of AC circuits
- Impedance and power factor
- Power and energy in AC circuits



Topic 1.2

Generation, transmission and distribution of electricity

- Electricity-An energy form
- Power systems
- Generation of electricity
- Renewable and non renewable sources
- Power transmission and equipment used
- Power distribution and equipment used
- Overhead lines and cables
- Electricity tariff principles



Topic 1.3

Electricity utilisation

- Electricity the preferred energy carrier
- Heating and melting applications
- Lighting
- Motive power
- Role of power electronics in the control of electricity
- Need for electrical safety

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

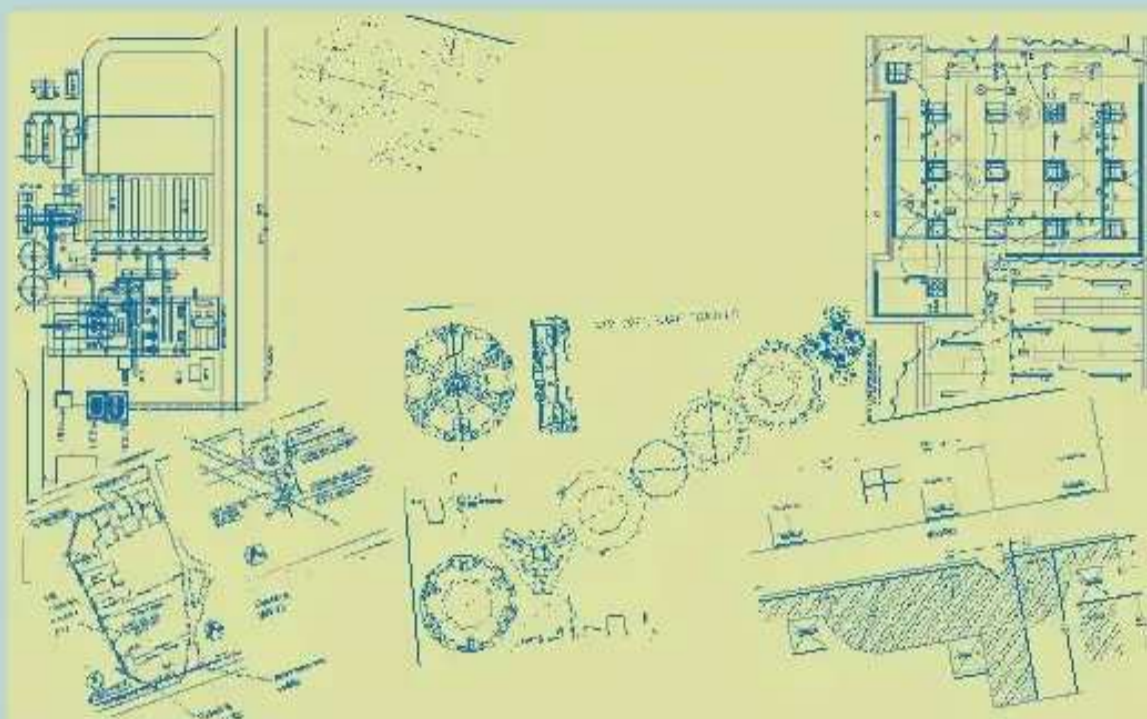
Overview

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
- Common distribution system alternatives

Topic 3.2

- Planning of power distribution system

Topic 3.3

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

Topic 3.4

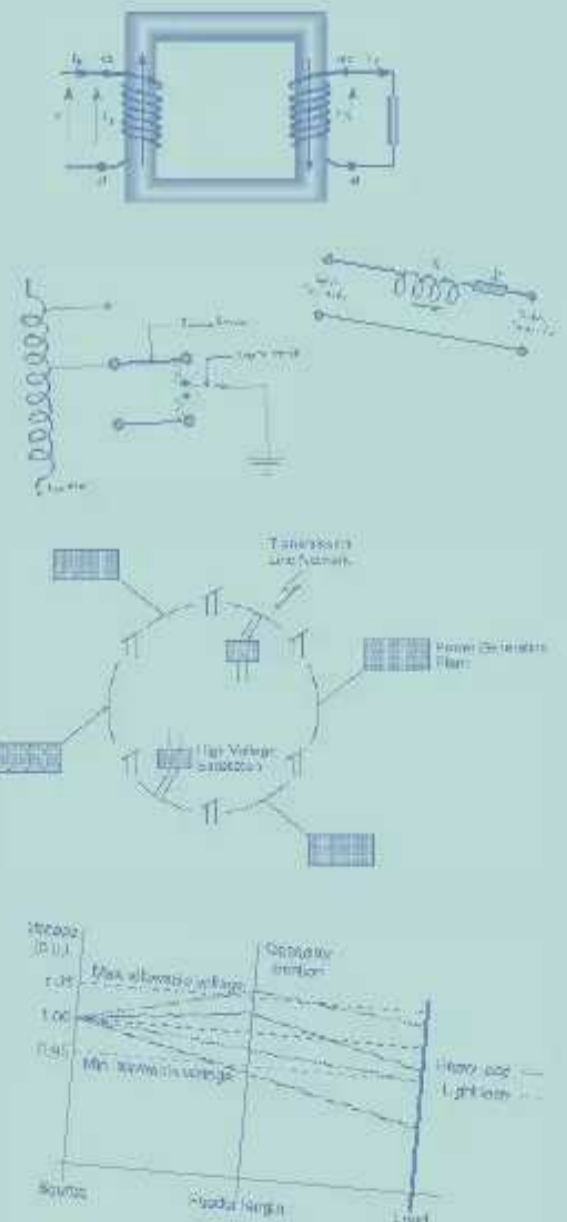
- Fault current evaluation of simple power distribution systems

Topic 3.5

- In-plant generation requirements and alternatives
- Distribution equipment sizing

Topic 3.6

- 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

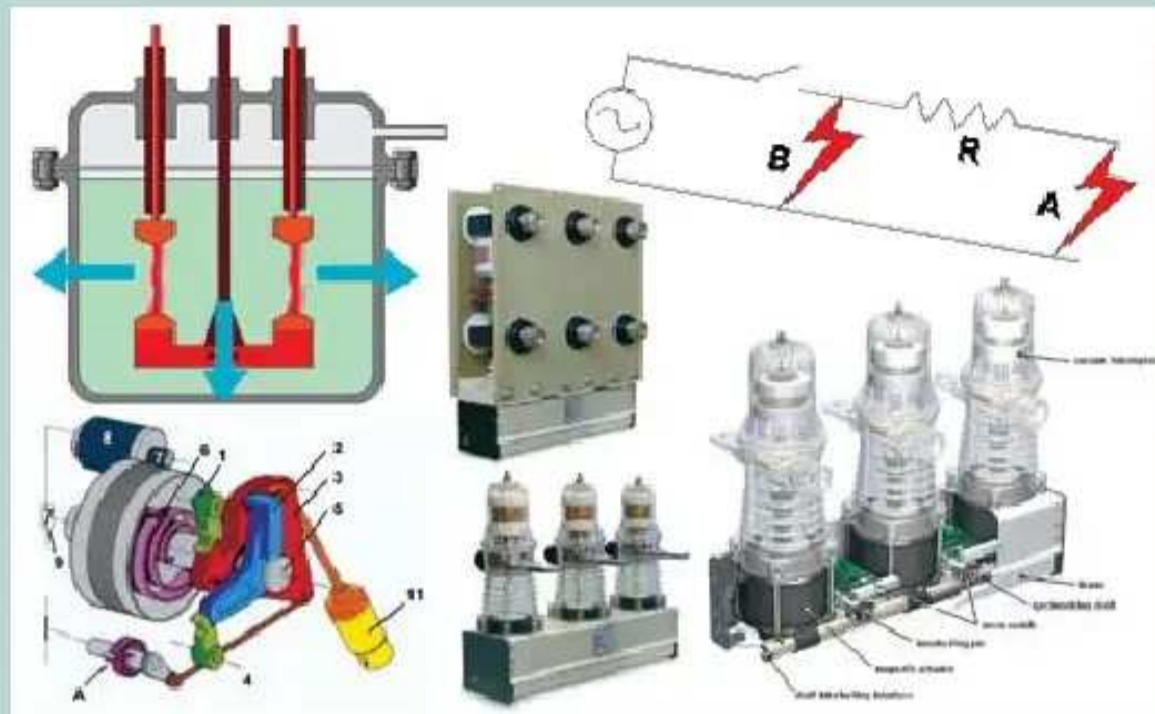
Overview

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

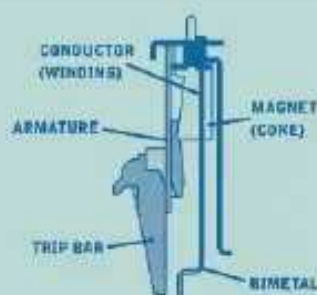
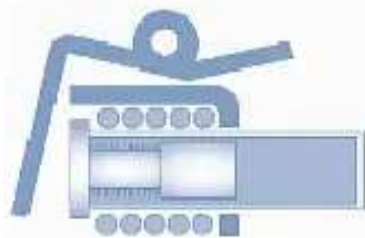
- MV circuit breakers
- Common types of MV circuit breakers (BOCB, MOCB, ABCB and SF6 CB)
- Construction examples
- Operating principles of different type of CBs
- Different types of CB operating mechanisms (manual, spring charged, solenoid operated)
- Design features of operating mechanisms
- Comparative merits
- Maintenance aspects of MV circuit breakers
- LV circuit breakers
- Common types of LV circuit breakers (ACB, MCCB, 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

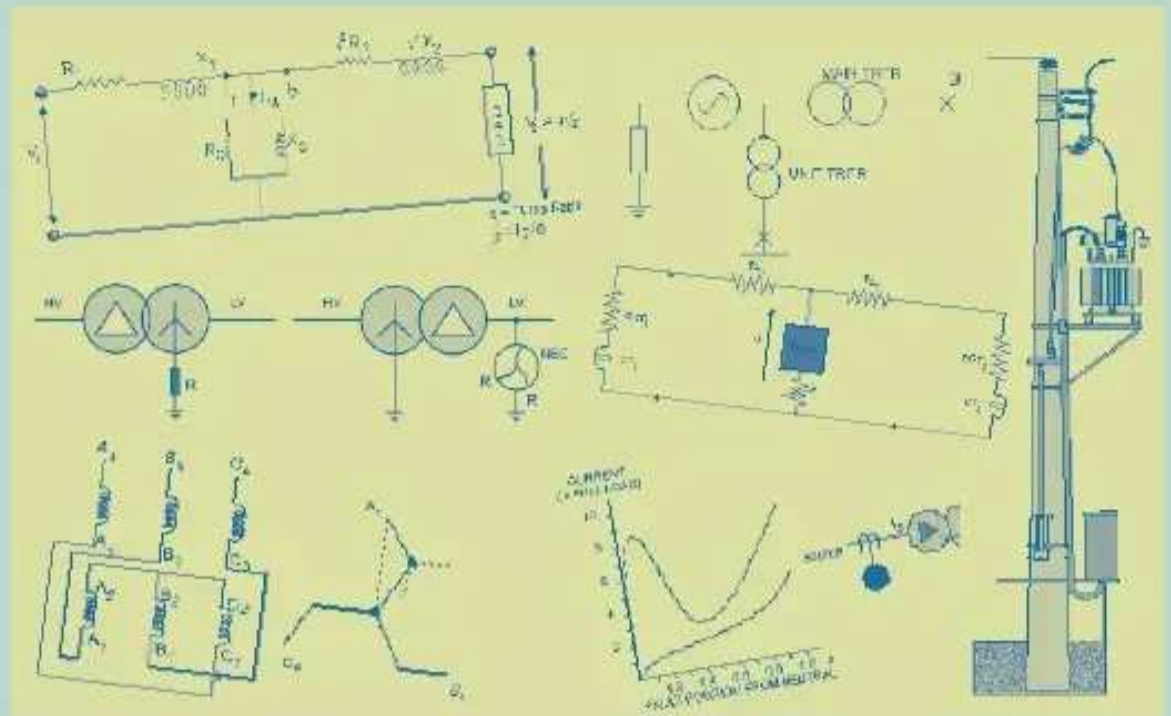
In today's world, the bulk of electrical power is generated in the form of AC using generators

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 amps 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

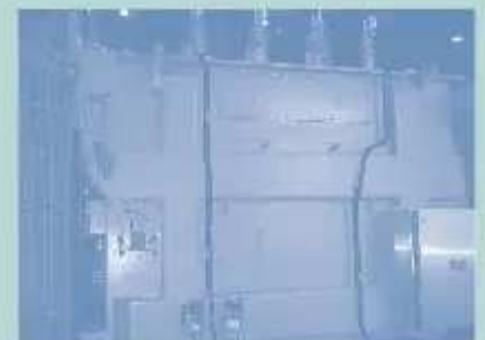
- Transformer construction
- Transformer types

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

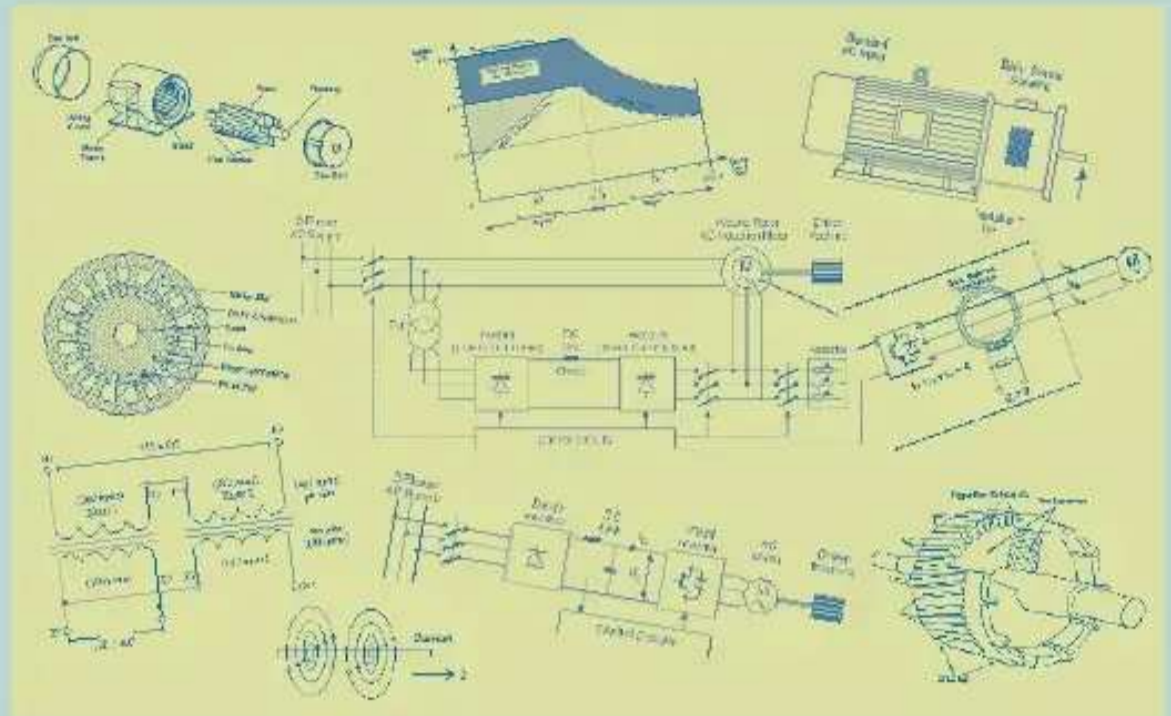
Overview

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)

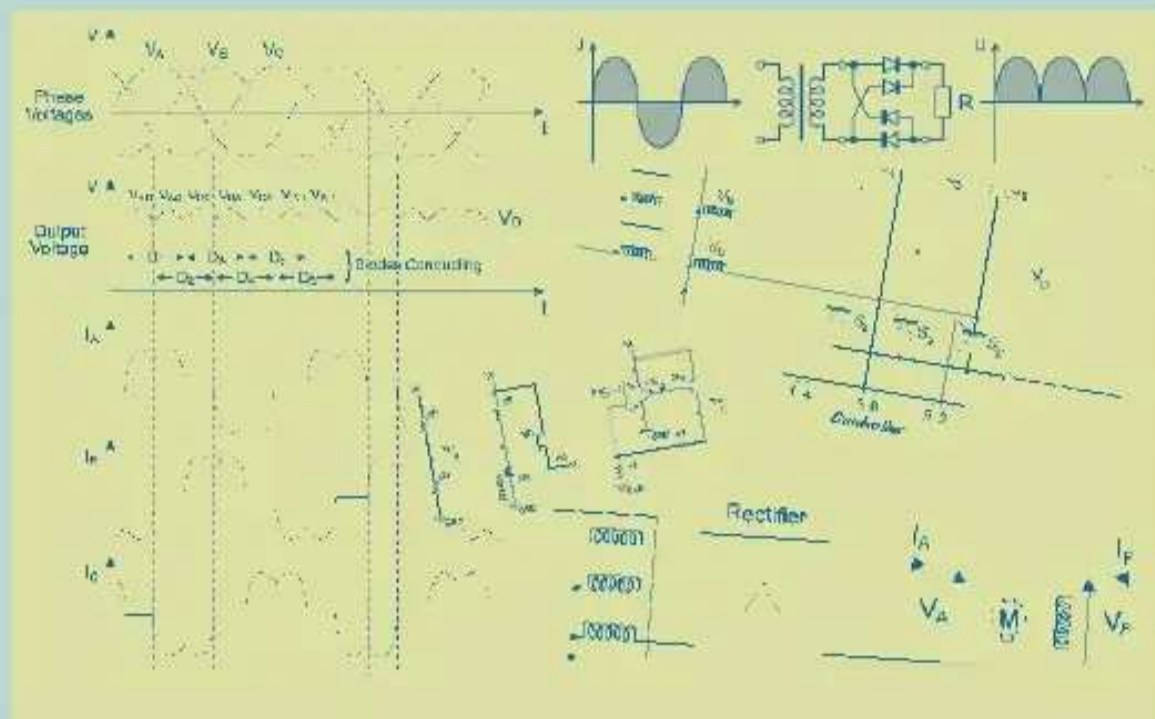
What you will learn:

- 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 PC's 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.



THE PROGRAM

Topic 8.1

- What is energy efficiency?
- Energy efficiency in processes using fuel directly
- Alternative energy sources

Topic 8.2

- Main forms of energy
- Electrical energy generation

Topic 8.3

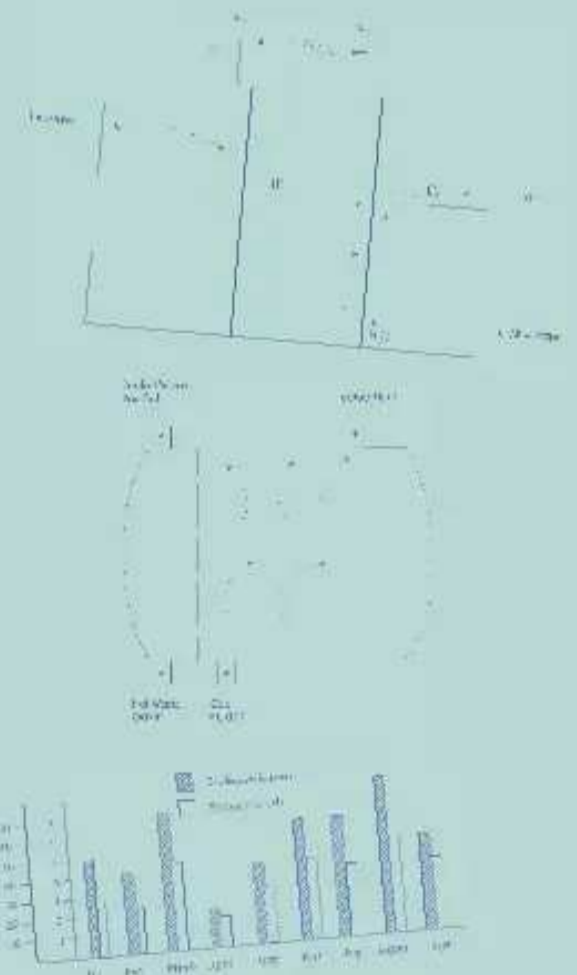
- Electrical energy usage
- Energy efficient practices in electricity use
- Energy efficiency in climate control applications

Topic 8.4

- Energy cost structure
- Introduction to energy audits
- Instrumentation for audits

Topic 8.5

- Audit areas
- Financials and costings



Practical Exercises

- Case studies of typical energy saving applications

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

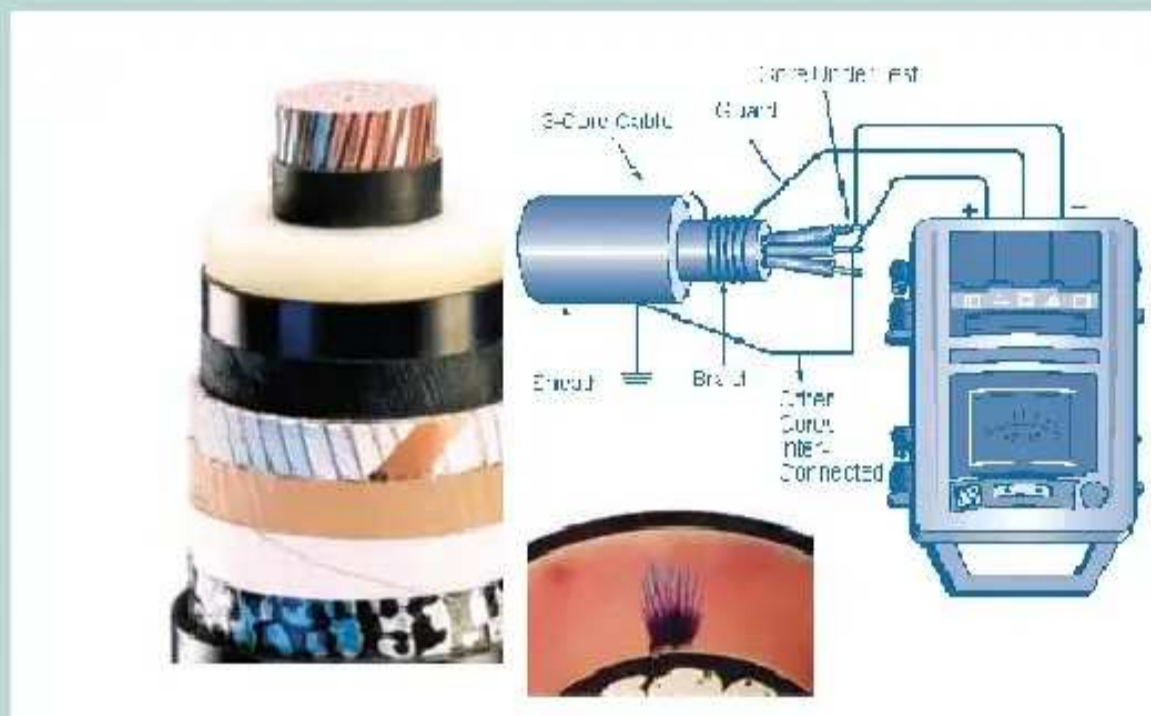
Cables are one of the most expensive assets in a power distribution network. Technical staff need to have expert knowledge in selection, application, installation and tools available for fault location combined with experience in order to achieve outstanding service reliability. This module is designed 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

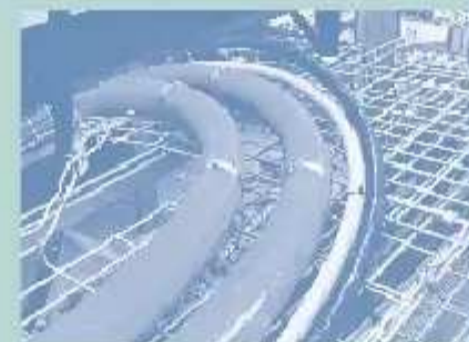
Topic 9.4

- Commissioning and periodic testing
- Failure modes and fault detection

- New trends in cable technology

Topic 9.5

- Cabling and Earthing: Convergence



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

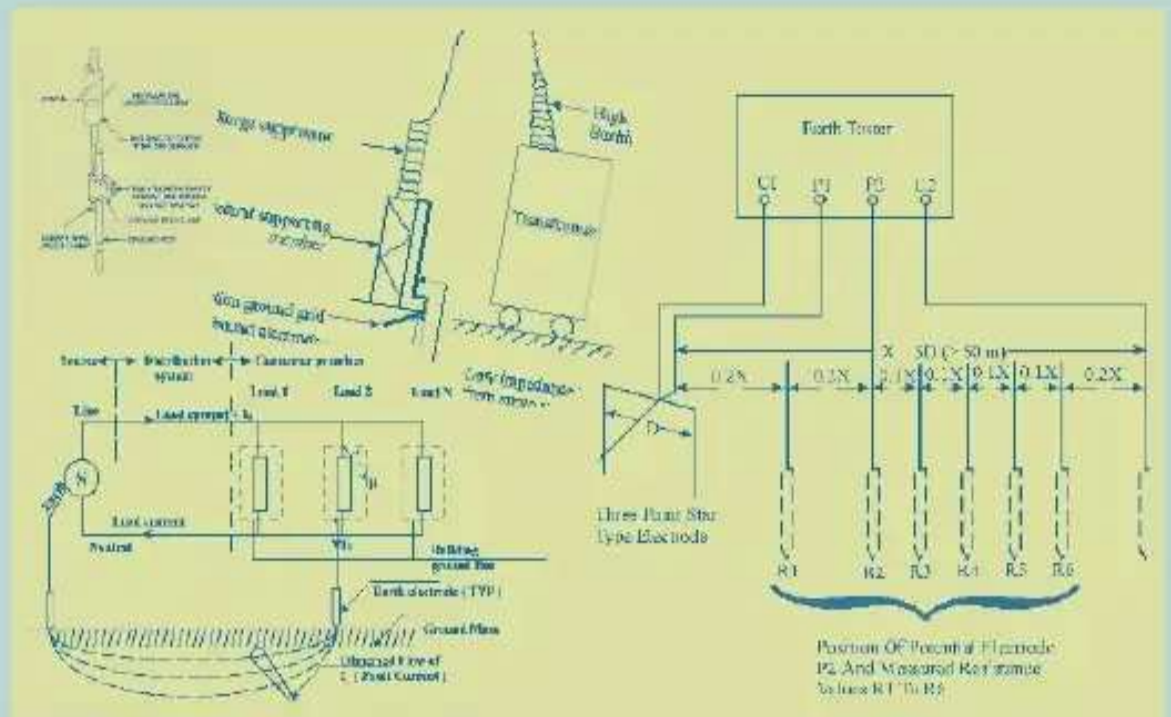
Overview

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



THE PROGRAM

Topic 10.1

- Electrical system earthing
- Protective earthing

Topic 10.2

- Earth electrode systems

Topic 10.3

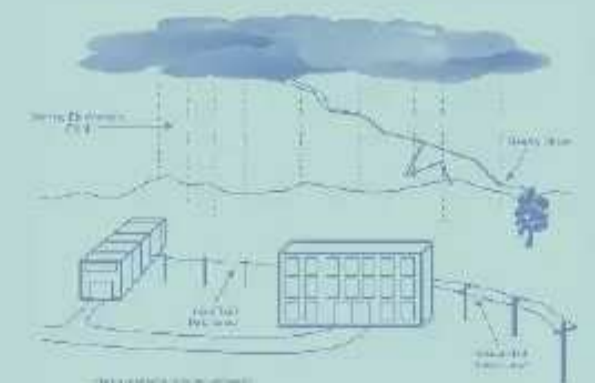
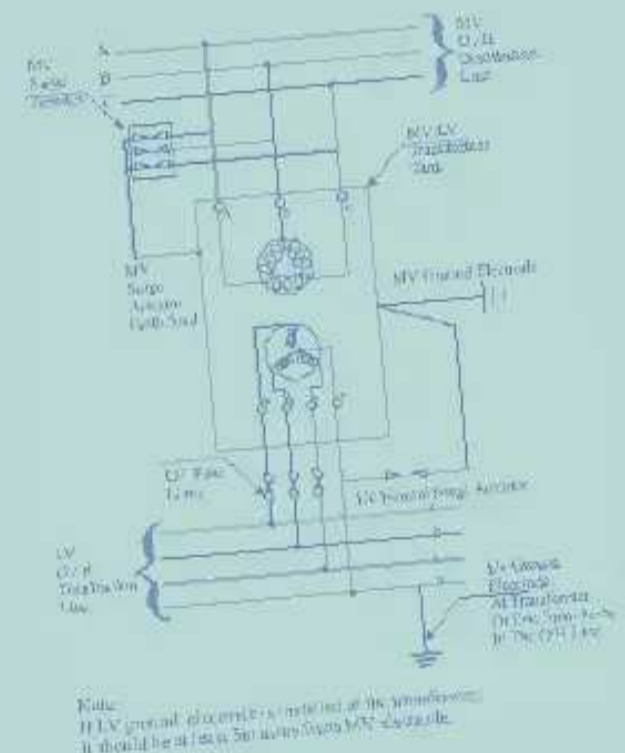
- Earthing design of substations
- Static Electricity and Protection
- Lightning and protection against lightning
- Lightning safety

Topic 10.4

- Lightning protection of structures, electrical lines and substations
- Lightning risk assessment
- Lightning protection of marine electrical systems

Topic 10.5

- Surge protection - part 1
- Surge protection - part 2
- Electrical noise and mitigation-role of earthing



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 electro-dynamically. 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



THE PROGRAM

Topic 11.1

- Need for protection
- Grounding in the context of protection
- Fuses

Topic 11.2

- Instrument transformers

Topic 11.3

- Circuit breakers
- Tripping power source

Topic 11.4

- Low voltage network protection
- Relays and relay coordination
- Mine underground distribution protection

Topic 11.5

- Principles of unit protection
- Switchgear (busbar) protection
- Feeder protection cable feeders and overhead lines

Topic 11.6

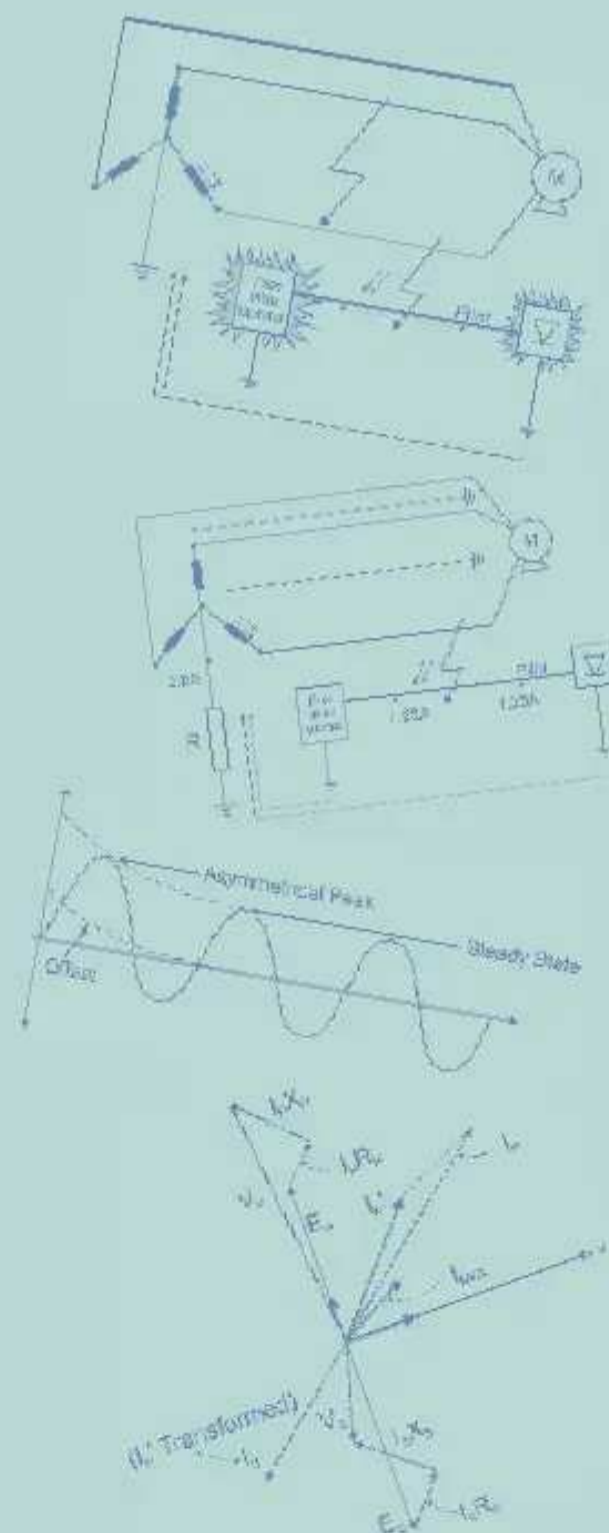
- Transformer protection

Topic 11.7

- Motor protection relays

Topic 11.8

- Generator protection
- Management of protection



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 - part 1
- Hazards due to electrical arcing and heating - part 2

Topic 13.3

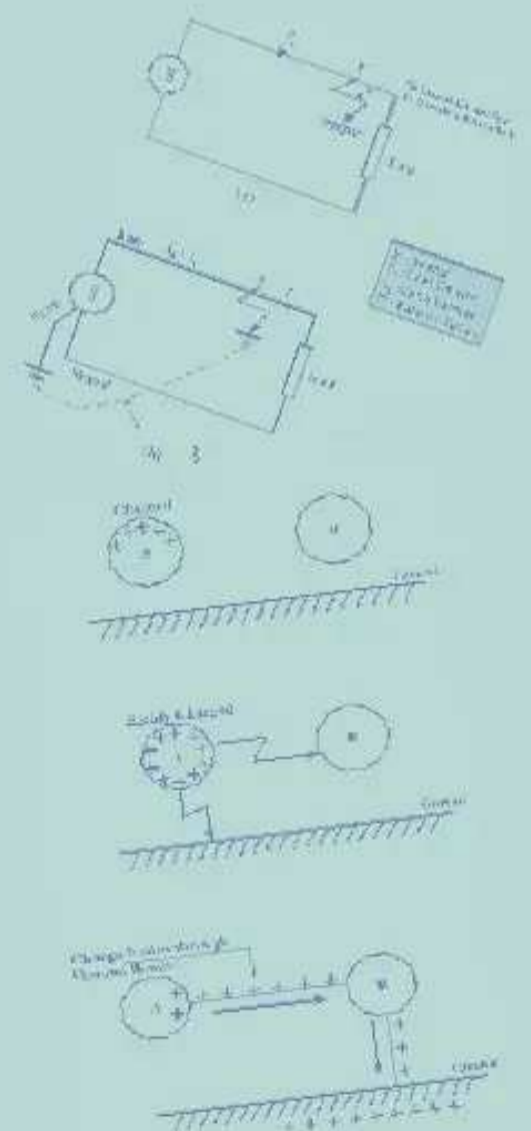
- Safety aspect in electrical design and selection
- Safe operation and maintenance

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

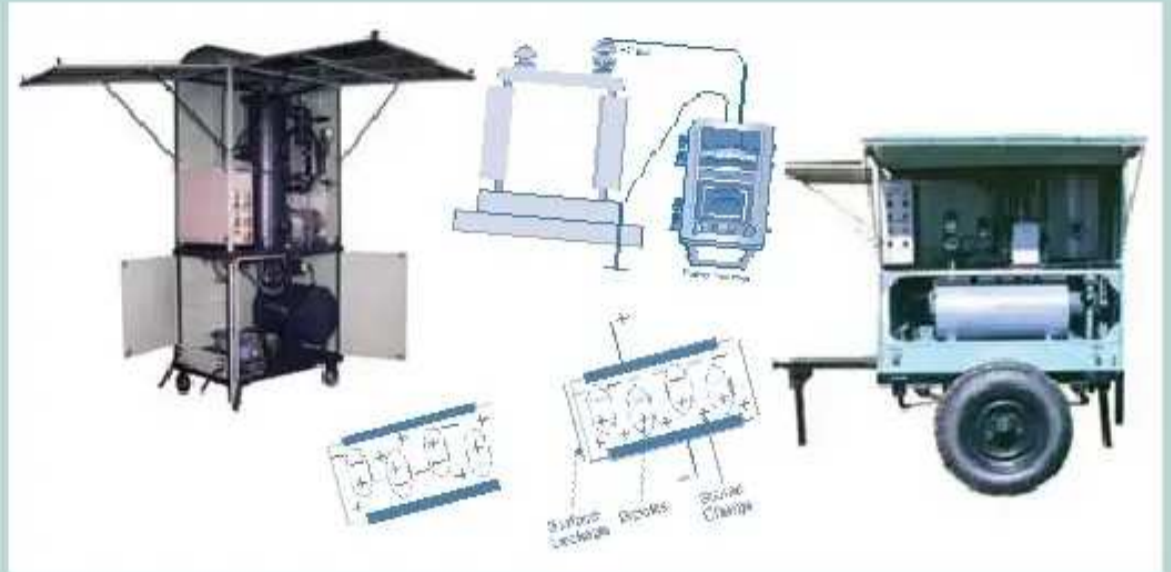
Testing is an essential activity in any engineer's career. Whatever your role in industry - electrical designer, purchase engineer, manufacturer, installation contractor or maintenance engineer - a solid knowledge of tests to be carried out on a given piece of electrical equipment and interpretation 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



THE PROGRAM

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

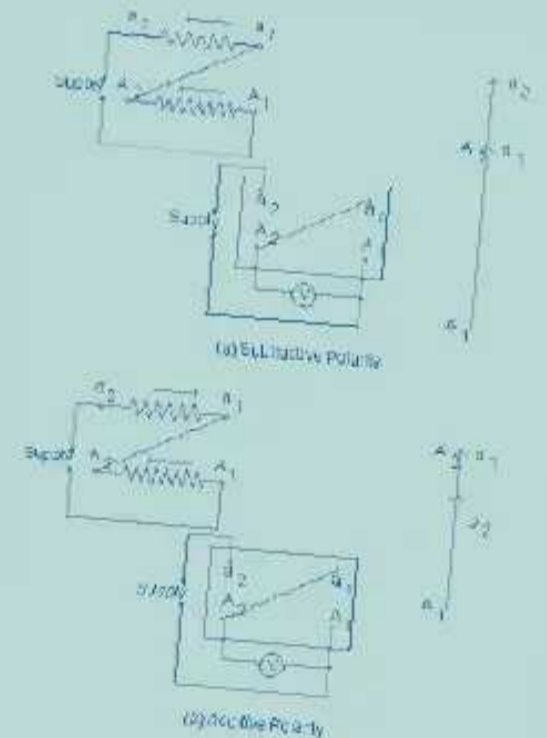
- Partial Discharge (PD) testing
- Impulse testing
- Measuring of low resistances as part of testing

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



Module 15: Power Quality Fundamentals

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

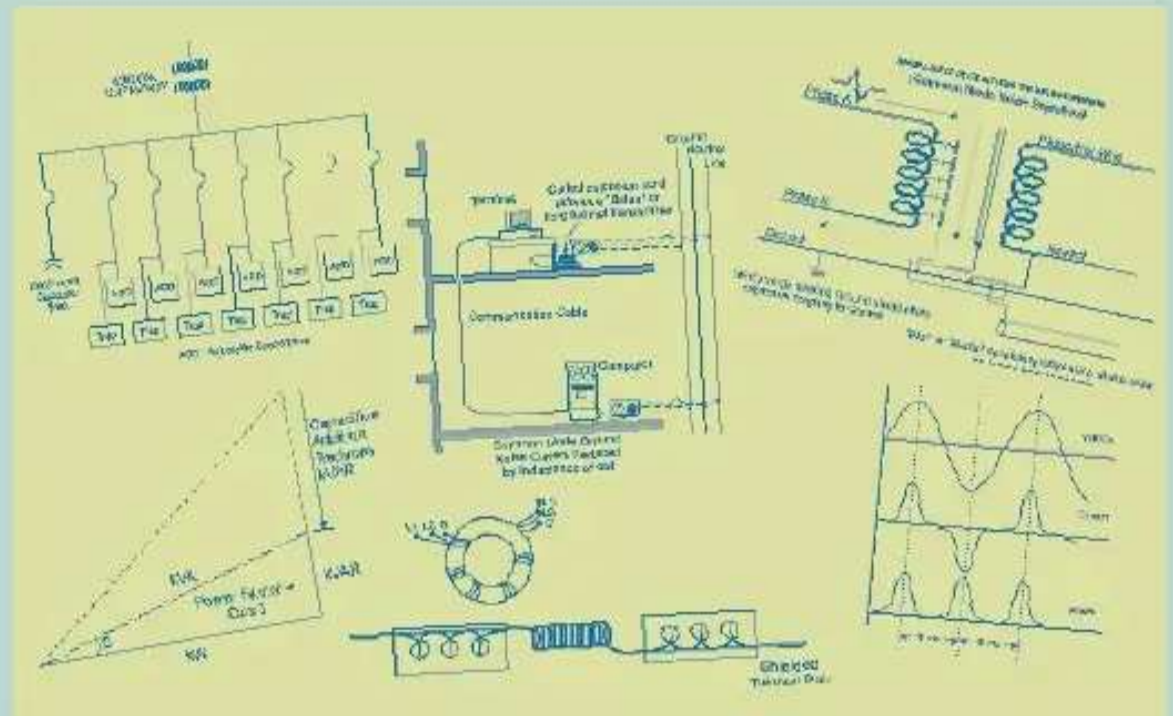
Inadequate power quality is one of the main reasons for unsatisfactory operation and failure of electrical equipment. In this module, you will learn what is meant by power quality and the factors that make the power quality less than perfect. It covers the various parameters that determine power quality, 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

Topic 15.4

- Power Quality Fundamentals – Case Studies

