



PROFESSIONAL CERTIFICATE OF COMPETENCY IN
**POWER ELECTRONICS,
SWITCH MODE
POWER SUPPLIES AND
VARIABLE SPEED DRIVES**

FOR ELECTRICAL, INSTRUMENTATION
AND CONTROL SYSTEMS



12 MODULES OVER 3 MONTHS

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

Keep you and your company one step ahead with this
comprehensive overview of Power Electronics,
Switch Mode Power Supplies and Variable Speed Drives

Bring yourself up to speed in the latest trends and technologies

WHAT YOU WILL LEARN:

At the end of this course you will be able to:

- Demonstrate a sound understanding of how switch mode power supplies operates
- Correctly select components and topology for a switch mode power supply
- Evaluate the performance and stability of a switch mode power supply design
- Understand how AC Variable Speed Drives (VSDs) work
- Select the right VSD for a given application
- Troubleshoot VSDs competently
- Explain how flux-vector control works for drive applications
- Understand squirrel cage induction motors
- Identify the protection and control system requirements for VSDs
- Understand the causes of motor burnout
- Effectively deal with VSD harmonics and EMC/EMI problems

Presented by

**George
Marx**

Pr.Eng, B Sc (Eng) Senior Engineer



ENROL NOW: Fax the enrolment form to us,
or email enquiries@eit.edu.au



Institute of Measurement and Control
Concession Member



ACPET
AUSTRALIAN COUNCIL FOR
PRIVATE EDUCATION AND TRAINING



SAIMC
IEEE



BENEFITS OF LIVE E-LEARNING

- Attend lessons in an online classroom with your instructor 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 while you travel - all you need is an Internet connection
- Have 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
- Learn from international industry experts, based around the globe
- Live interactive webinars, not just a 'book on the web'
- Receive a certificate of completion for CPD purposes

PRESENTATION FORMAT

The certificate program features real-world applications and uses a multi-pronged approach involving self-study, interactive online webinars and homework assignments with a mentor on call. The course consists of 12 modules, over a period of 3 months.

Some modules may involve a practical component or group activity. For each module there will be an initial reading assignment along with coursework or problems to be handed in and practical exercises in some cases. Participants will have ongoing support from their instructor and course coordinator.

Course reading material will be delivered in electronic (PDF) format in advance of online presentations. Presentations and group discussions will be conducted using a live interactive software system. Assignments will be submitted electronically and wherever possible, practical exercises will be conducted using simulation software and remote labs.

LIVE WEBINARS

During the program you will participate in 6 live interactive sessions with the instructor and other participants from around the world. Each webinar will last approximately 60 to 90 minutes, and we take student availability into consideration wherever possible before scheduling webinar times. Contact us for details of webinar session scheduling. All you need to participate is an adequate Internet connection, speakers and a microphone. The software package and setup details will be sent to you prior to the course.

PRESENTED BY GEORGE MARX

Pr Eng, B Sc (Eng) Senior Engineer



George Marx has over 20 years of experience in the fields of Power Electronics from design to industrialisation. Starting his career on the power system protection side, he migrated to EMC and power systems.

George's portfolio of achievements includes the design of power systems, switch mode power supplies, UPS and high precision servo amplifiers for high reliability military applications. Battery and inverter design for industrial systems, such as solar panel applications, vehicle management, specialised computer systems and high current starter for vehicle plants. George is a lecturer and course designer of industrial and power electronics for Technikon SA (UNISA). He is also a project manager/system engineer of video systems for UAV's and the development of a high resolution infra-red camera for industrial and military application.

12 MODULES OVER 3 MONTHS

OVERVIEW

Power electronic circuits have revolutionised almost every device that we use today from PCs to TVs, 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 course 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. The course 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 will be discussed in detail. The course also 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 of the course 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.

INCLUDES 4 FREE REFERENCE MANUALS

VALUED AT OVER US\$400

YOU WILL RECEIVE 4 OF OUR UP-TO-DATE
TECHNICAL E-BOOKS TO ADD TO YOUR LIBRARY.

- Practical Earthing, Bonding, Lightning and Surge Protection
- Troubleshooting, Maintenance & Protection of AC Electrical Motors and Drives
- Power Electronics and Switch Mode Power Supply
- Practical Variable Speed Drives for Instrumentation and Control Systems

Received upon completion.

All materials required for the course will be provided electronically, in smaller, easy-to-read sections.

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



COURSE OUTLINE

MODULE 1: Introduction to Power Electronic Circuits and Devices

- Introduction
- Definitions and basic principles
- Power diodes and thyristors
- Principles of commutation
- Power electronic rectifiers
- Power electronic inverters
- Gate commutated converters
- Gate controlled devices - GTO, FCT, GTR, FET, IGBT
- Block diagram of power electronic circuits

MODULE 2: Introduction to Switch Mode Power Supplies

- Basic principles of PSU circuits
- Linear and SMPS comparison
- Comparison of topologies
- Non-isolated topologies
- Isolated topologies
- PWM controller review
- Speed critical path
- Choice of topology based on power supply specifications

MODULE 3: Switch Mode Power Supply Design 1

- Component selection and design criteria for input section
 - Input rectifiers
 - Input filter capacitors
- High frequency transformer design
 - Basic transformer theory
 - Core material and geometry selection
 - Design of a power transformer for a PWM push-pull converter.
 - Losses and temperature rise
 - Winding techniques

MODULE 4: Switch Mode Power Supply Design 2

- Output rectification and filtering
- Power rectifier characteristics
- Output power inductor design
- Output filter capacitor design
- Heat sinking
 - The thermal equation
 - Selecting a heatsink
 - Custom heatsink

MODULE 5: Switch Mode Power Control and Stability

- Transfer functions
- Criteria for stability
- Control to output gain
- Design compensation network
- Control stability measurements

MODULE 6: Introduction to Variable Speed Drives

- Need for variable speed drives
- Fundamental principles of speed control
- Efficiency, torque, inertia, horsepower/power factor

- Torque-speed curves
- How the motor produces torque
- Types of variable speed drives

MODULE 7: 3-Phase Induction Motors

- Basic construction and physical configuration
- Principles of operation and performance
- Equivalent circuit and fundamental equations
- Starting, acceleration, running and stopping
- Power, torque and thermal rating

MODULE 8: Protection of Motors

- AC frequency converter protection
- Fault diagnostics
- Electric motor protection
- Thermal overload protection - current sensors
- Thermal overload protection - direct temperature

MODULE 9: Control System for AC Variable Speed Drives

- Overall control system
- Power supply to the control system
- DC bus charging system
- VSD control loops (open-loop, closed-loop)
- Vector control and its applications
- Current feedback in AC variable speed drives
- Speed feedback from the motor

MODULE 10: Selection of AC Converters for Variable Speed Drives Applications

- Basic selection procedure
- Load ability of converter fed induction motors
- Operation in the constant power region
- Nature of the machine load
- Starting and stopping VSDs (motor braking)
- How to calculate acceleration torques and times
- How to select the correct motor and converter for pump and fan loads
- How to select the correct motor and converter for constant torque loads, such as conveyors
- Summary of the selection procedure

MODULE 11: Electromagnetic Compatibility (EMC)

- Sources of electromagnetic interference
- Noise specifications & RFI sources in SMPS
- Filters for RFI suppression
- Harmonics on the power supply side of AC converters
- Effect of harmonic distortion on other connected equipment
- Methods of reducing the effect of supply side harmonics

MODULE 12: Installation and Fault Finding Techniques

- Troubleshooting of SMPS
- General installation and environmental requirements
- Power supply connections and earthing
- Where to install the contactors in the power circuit
- Installing AC converters into metal enclosures

PRACTICAL EXERCISES

Throughout the course you will participate in hands-on exercises using simulation software, which will help you put theory to practice immediately!

HARDWARE AND SOFTWARE REQUIREMENTS

All you need to participate 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.

CERTIFICATION

Participants completing all the assignments and achieving 60% or more for their final mark, as well as attending 65% of the live webinars, will receive the Engineering Institute of Technology Professional Certificate of Competency in Power Electronics, Switch Mode Power Supplies and Variable Speed Drives.



ON-SITE TRAINING

We can provide our training at the venue of your choice. On-site training can be customised and by bringing the trainer to site the dates can be set to suit you!

“The Customer is Always Right” – so tell us what you need and we will design a training solution at your own site.

For a FREE detailed proposal please contact Kevin Baker via e-mail: training@idc-online.com