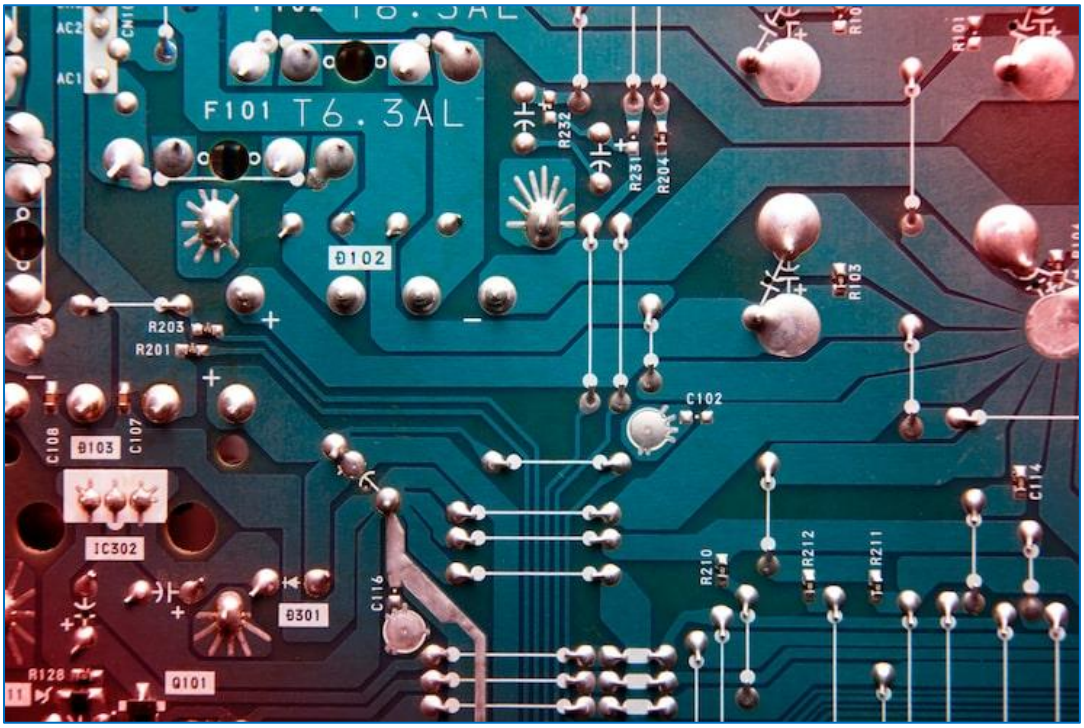

EE372:
Advanced Circuits and Electronics

Training Description:

This Advanced Circuits and Electronics training course provides participants with an **in-depth understanding** of advanced electronic circuit principles, circuit analysis techniques, semiconductor devices, analog and digital electronics and modern electronic system applications. The course focuses on strengthening participants' technical knowledge and practical skills in analyzing, designing, testing and troubleshooting electronic circuits used in industrial, electrical, instrumentation and control applications.

Participants will explore advanced circuit analysis methods, operational amplifiers, transistor-based circuits, power electronics, digital logic systems, signal conditioning and electronic measurement techniques. Practical exercises and **circuit simulation activities** will help participants understand circuit behavior, identify component-level faults, evaluate performance and apply systematic troubleshooting methods.

By combining theoretical foundations with practical applications, the program enables participants to improve electronic circuit reliability, diagnose complex faults and make informed technical decisions in the maintenance, design and operation of electronic systems.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Apply advanced electrical circuit analysis techniques to complex AC and DC circuits
- ✓ Analyze circuit behavior using network theorems, transient analysis and frequency response methods
- ✓ Evaluate the characteristics and applications of semiconductor devices, including diodes, BJTs, MOSFETs and other electronic components
- ✓ Analyze and troubleshoot analog circuits, operational amplifiers, filters, oscillators and signal-conditioning systems
- ✓ Understand digital electronics, logic circuits, sequential systems and basic interfacing principles
- ✓ Explain the operating principles of power electronic converters and switching circuits
- ✓ Use electronic test instruments and simulation tools to evaluate circuit performance
- ✓ Apply systematic troubleshooting techniques to identify component failures, signal abnormalities, and circuit malfunctions
- ✓ Improve the reliability, performance, and maintainability of electronic circuits used in industrial applications

EXPECTED TRAINING OUTCOMES:

Upon completion, participants will have strengthened their ability to analyze advanced electronic circuits, understand semiconductor and integrated circuit applications, evaluate analog and digital systems and troubleshoot common faults in industrial electronic equipment. They will also gain practical experience in circuit simulation, waveform interpretation, electronic measurement and systematic fault diagnosis.

The acquired knowledge and skills can be applied to industrial maintenance, instrumentation and control, electronic equipment testing, automation systems, power electronics and related electrical engineering applications.

Training Designed for:

This training course is intended for Electrical and Electronics Engineers, Electronics and Electrical Technicians, Instrumentation and Control Engineers, Industrial Maintenance Engineers and Technicians, Automation and Control System Specialists, Electrical and Electronics Maintenance Supervisors, Testing, Commissioning and Troubleshooting Personnel and Technical Professionals involved in electronic equipment design, operation and maintenance

Prerequisites: Participants should have a basic understanding of electrical circuits, electronic components, and fundamental electrical engineering principles.

Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

- ❖ Advanced Circuit Analysis and Electrical Network Principles
  - Review of advanced DC and AC circuit concepts
  - Circuit analysis using mesh current and nodal voltage methods
  - Application of Thevenin's and Norton's theorems
  - Superposition, maximum power transfer and source transformation
  - Analysis of complex series-parallel networks
  - Capacitor and inductor behavior in transient circuits
  - First-order and second-order circuit response
  - AC circuit analysis using phasors and complex impedance
  - Resonance in series and parallel RLC circuits
  - Introduction to frequency response and impedance analysis
  - **Practical Exercise:** Analyze an RLC circuit, calculate its response and verify theoretical results through circuit simulation.

DAY TWO:

- ❖ Semiconductor Devices and Advanced Analog Electronics
  - Semiconductor fundamentals and PN junction characteristics
  - Advanced diode applications, including rectifiers, clamping and clamping circuits
  - Zener diodes, voltage regulation and protection circuits
  - Bipolar junction transistors (BJTs): characteristics and operating regions
  - MOSFET operation, switching behavior and amplification
  - Transistor biasing, small-signal models and amplifier configurations
  - Single-stage and multistage amplifier circuits
  - Operational amplifiers: characteristics and practical limitations

- Inverting, non-inverting, summing, and differential amplifiers
- Active filters, oscillators, and signal-conditioning circuits
- **Practical Exercise:** Analyze and simulate transistor amplifiers, operational amplifier circuits and basic signal-conditioning applications.

DAY THREE:

❖ Digital Electronics and Integrated Circuit Applications

- Digital number systems and binary arithmetic
- Boolean algebra and logic simplification
- Combinational logic circuits and logic gate applications
- Multiplexers, demultiplexers, encoders and decoders
- Flip-flops, registers, and counters
- Sequential logic circuits and timing principles
- Analog-to-digital and digital-to-analog conversion
- Introduction to microcontrollers and digital interfacing
- Integrated circuit characteristics and interfacing considerations
- Digital signal integrity, noise and basic circuit protection
- **Practical Exercise:** Design and simulate a digital logic circuit using combinational and sequential components, then evaluate its operation under different input conditions.

DAY FOUR:

❖ Power Electronics and Electronic Control Circuits

- Fundamentals of power semiconductor devices
- Switching characteristics of power diodes, BJTs, MOSFETs and IGBTs
- Single-phase rectifiers and DC power supply circuits
- Voltage regulation and switched-mode power supply principles
- DC-DC converters: buck, boost and buck-boost configurations
- Fundamentals of inverter operation and DC-AC conversion
- Pulse-width modulation (PWM) and switching control techniques
- Gate drivers, snubber circuits and semiconductor protection
- Thermal management, efficiency and power losses
- Applications in motor drives, industrial control and renewable energy systems
- **Practical Exercise:** Analyze a power converter circuit, examine switching waveforms and identify potential causes of excessive ripple, overheating, or unstable output.

DAY FIVE:

❖ Electronic Measurements, Troubleshooting and System Reliability

- Electronic test equipment and measurement fundamentals
- Practical use of digital multimeters, oscilloscopes and function generators
- Signal measurement, waveform interpretation and frequency analysis
- Circuit simulation and comparison of predicted and measured results
- Systematic troubleshooting of analog and digital circuits
- Identifying common component failures and abnormal operating conditions
- Fault isolation in power supplies, amplifiers and electronic control circuits
- Grounding, shielding, noise reduction and electromagnetic compatibility fundamentals
- Thermal stress, component ratings and electronic circuit reliability
- Preventive maintenance and electronic equipment testing
- Integrated case studies involving complex electronic circuit faults

- **Practical Exercise:** Perform a structured troubleshooting exercise to diagnose a simulated electronic circuit fault, identify the root cause and recommend corrective actions.

❖ Course Conclusion
❖ POST-ASSESSMENT and EVALUATION

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

USD$ TBA - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:
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