



Course Offerings

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GPAllied is the most diverse reliability and operations consulting and services company in the world. Combined, our unrivaled technical expertise, solutions portfolio and global reach help you achieve rapid bottom-line improvement and sustained cultural change.

GPAllied diversity and expertise result from joining together firms with experts in Maintenance and Reliability, Operational Excellence, and Workforce Development. This winning team allows us to offer you expertise in the fields of Lean, Reliability Engineering, Six Sigma, Condition Monitoring, Change Management, Maintenance Planning and Scheduling, Workforce Development and Maintenance Craft Skills training. However, only GPAllied can offer you solutions that fully integrate these specialties.

To ensure that GPAllied provides you with latest thinking and proven best practices, we have attracted recognized experts to our team, benchmarked best-in-class operations and connected with thought leaders throughout the industry. Furthermore, we ensure that our project team members have technical expertise, as well as expertise as trainers and mentors through a rigorous qualification process and the establishment of work execution standards.

GPAllied has modeled their deliverables based on the following core beliefs:

- The reason our clients are in business is to make money
- The first step to ensuring profitability is to have reliable “systems”
- The term “system” speaks to the combination of the people who operate the equipment, the processes they follow to operate the equipment and the equipment itself
- The definition of reliable is: the ability to perform a given task, at a stated rate, for a given period of time, under a given set of circumstances
- The organization must be motivated and prepared for any change to be sustainable
- Having successfully attained reliability, sustaining the improvements is paramount to on-going success
- Optimization is achieved through the use of a culture of continuous improvement
- Clients require a rapid return on investments

To that end, GPAllied offers you a complete suite of solutions in the following categories:

- Sustained Reliable Operations
- Reliable Capital Delivery
- Reliable Maintenance Execution

GPAllied prides itself on two (2) things: our passion for helping the client and the flexibility of delivery methods.

Our passion is driven by *the satisfaction of seeing our company help our customers build, utilize and realize the power of the Return on Asset Reliability (ROAR™).*

Our flexibility in delivery methods comes in any one of four (4) different ways. Each way specifically customized to meet the unique needs of the client. Those four (4) ways are:

Training

GPAllied offers all of our deliverables as classes for the client who prefers to implement using their own people.

Coaching

For the client who wants more than a training solution, but still prefers to implement using their own personnel, GPAllied offers a combination training/coaching package. The training class is augmented by a regimen of coaching and mentoring by our experienced consultants.

Services

Some clients prefer to contract out certain functions. GPAllied can deliver our services to the client in one of two forms:

- Project Based – GPAllied personnel are on-site for the duration of the project
- Full Time Equivalent (FTE) – GPAllied personnel are on-site, full time as contracted employees

Consulting

Whether you are starting a major change initiative or looking for the best way to improve performance, GPAllied's consultants guide you as you set your direction, design and deploy your approach, and realize results.

The GPAllied vision is to be the premier global provider of sustainable transformation driving improved customer operational and reliability excellence. To that end, we believe the best way to make our vision a reality is to optimize customer business performance through customized solutions utilizing our experienced people, innovative processes, and proven technologies.



Thus achieving operational and reliability excellence sustained through the use of cultural change management with the relentless pursuit to deliver the highest return on investment.

GP*Allied's* expert team provides unparalleled solutions. You can count on us to provide the following:

- A strong foundation to ensure that your organization's systems reliably meet customer needs with lower cost
- A roadmap to build upon that foundation to streamline your processes and help you achieve a culture of sustained continuous improvement
- Effective training to develop your people
- Consultants and trainers with technical expertise, interpersonal skills, and drive to work effectively with your team
- Solutions customized to fit your needs, drawing from a diverse range of methods and services
- A rapid return on your investment

Training Classes

At GP*Allied*, we understand that you are not interested in "training for training's sake". You need hard-hitting, impactful training that addresses the specific need of your employees, delivers value for your training dollars, and produces bottom-line results.

That's what we deliver.

In today's increasingly competitive business environment, your training investment only makes sense if it yields a tangible improvement in KPI's like:

- Production efficiency
- Employee retention
- Labor costs
- Asset downtime
- Safety
- Quality control

With over 200 courses that can be easily customized to your equipment and processes, we are the one-stop shop for all of your technical and change management training needs. We offer these classes on-site at your facilities, for your employees; or periodically around the world on an open-enrollment basis.

When you select us for your training, you receive:

- Training from practitioners and implementers who are also skilled trainers.
- Courses designed with your learning objectives in mind using professional instructional system design combined with our subject-matter expertise.

You can obtain most of the courses in a format that works best for you:

- **Off the Shelf**— you can select our standard training if a generic course suits your needs.
- **Customized** — you can ask us to make minor modifications to better fit your organization's existing terminology and culture (which we can do quickly and cost-effectively), or you can ask us to develop a truly custom curriculum.

- **Public Courses** — you may decide to attend one of our expanding list of publicly offered courses, including those offered through Macomb Community College Workforce Development Institute in Warren, MI.
- **e-Learning** — for certain courses; you can select e-Learning, or a blended solution of e-Learning, instructor-led training, and coaching.

Industrial Electronics

DESCRIPTION

This course provides information on the function and circuit analysis of power supplies, amplifiers, integrators, comparators, and oscillators. There are hands-on exercises for wiring and analyzing the various circuits. Upon completion of this course, the participants will be able to assemble and analyze common electronic circuits.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Discuss the basic structure of a semiconductor atom and the movement of free electrons and holes.
- Discuss the purification and doping of semi-conductors.
- Describe the p-type region, n-type region, and junction of a PN junction diode.
- Discuss the characteristic curves and specification ratings of a diode.
- Describe the operation of a light-emitting diode, a photoconductive device, and a photovoltaic device.
- Describe the differences between an NPN transistor and a PNP transistor and identify the schematic symbol for each.
- Discuss transistor performance in the active region, saturation region, and cutoff region.
- Explain how the three kinds of transistor connections affect circuit values.
- Discuss four common transistor characteristics.
- Describe several kinds of semiconductor packages.
- Explain how to identify leads.
- Describe methods for mounting components on PCBs and chassis.
- Explain how to use manufacturers' data sheets.
- Discuss the analysis of circuits by Q points and by characteristics.
- Discuss the advantages of PCBs over direct wiring.
- Explain why both flexible boards and rigid boards are used for printed circuits, and discuss the advantages and disadvantages of each.
- Explain how single-sided, double-sided, and multilayer boards are made.
- Describe the three classes of surface mount assemblies.
- Compare various soldering methods and discuss the advantages and disadvantages of each.
- Describe PCB connectors and mountings.
- Discuss PCB repair techniques and limitations.
- Discuss the basic functions of power supplies and power conditioners.
- Describe DC-to-DC, AC-to-AC, AC-to-DC, and DC-to-AC power supplies.

- Compare the operation of transformer-driven and oscillator-driven inverters.
- Discuss the functions of filters, voltage regulators, voltage dividers, switching power supplies, and ferroresonant power supplies.
- Explain why low voltages can be dangerous.
- Define the term rectifier.
- Explain how to interpret diode ratings on a manufacturer's specification sheet.
- Compare the effects of connecting diodes in parallel and in series.
- Describe the operation of a silicon-controlled rectifier.
- Compare the operation of half-wave and full-wave rectifiers.
- Discuss the operation of bridge and three-phase rectifiers and explain how voltage multipliers work.
- Name several kinds of filters used in power supplies.
- Discuss the effects of ripple and describe ways ripple is measured.
- Discuss the use of capacitors, inductors, and resistors in filter circuits.
- Compare the advantages and disadvantages of capacitance, inductance, RC, and LC power supply filters.
- Explain why capacitor power supplies should include bleeder resistors.
- Discuss the uses of bypass filters and input filters.
- Discuss the purposes of voltage regulators in power supplies.
- Explain the function of the control circuit and the current limiting circuit in series voltage regulators.
- Discuss the advantages of IC voltage regulators.
- Describe the operation of switching regulators and explain how it differs from that of other kinds of regulators.
- Discuss the use of SCRs and triacs in primary circuit regulators.
- Discuss at least five kinds of test equipment and tools used to troubleshoot power supplies.
- Describe the three main steps in troubleshooting a power supply.
- Describe the basic procedures for preliminary checks and power-off visual inspection and fuse tests.
- Describe the basic procedures for power-on tests and output tests.
- Explain how to perform section tests and part tests.
- Explain how gain, bandwidth, and distortion relate to amplifier operation.
- Compare bipolar transistor amplifiers and FET amplifiers.
- Explain how to use characteristic curves to predict transistor performance.
- Explain how to use an input/output curve to determine transistor gain.
- Discuss the effect of ambient temperature on amplifier performance.
- Discuss the uses of operational amplifiers and switching amplifiers.
- Discuss the transistor characteristics that define operating region limits.
- Explain how to draw an amplifier load line.
- Explain how to find the operating point of an amplifier.
- Discuss biasing as a means of establishing a stable operating point in an amplifier circuit.

- Discuss five ways that amplifiers can be classified and compare Class A, AB, B, and C amplifiers.
- Explain how to calculate amplifier power gain, efficiency, current gain, and voltage gain.
- Explain how nonlinearity and clipping cause amplifier distortion.
- Discuss the importance of impedance matching in interconnecting circuits.
- Explain how to calculate multistage amplifier gain and bandwidth.
- Compare the advantages and disadvantages of capacitive-coupled, transformer-coupled, and direct-coupled amplifiers.
- Describe the operation of differential amplifiers.
- Compare the properties of an ideal op amp and a typical actual op amp.
- Describe the operation of inverting amplifiers in terms of virtual ground.
- Compare the advantages of inverting amplifiers and noninverting amplifiers.
- Explain how integrators and comparators work.
- Explain how Zener diodes are used in squaring circuits.
- Describe the conditions needed to start and to sustain oscillation.
- Explain how positive feedback affects oscillation.
- Name three kinds of feedback networks used in oscillators.
- Discuss the advantages and disadvantages of tuned circuits, phase-shift oscillators, and crystal oscillators.
- Describe several common oscillator circuits.
- Discuss the differences between sine wave oscillators and square wave switching circuits.
- Explain how rise time and the time constant affect flip-flop circuits.
- Compare the operation of discrete transistor one-shots and IC one-shots.
- Explain how IC pairs of one-shots or IC op amps form an astable multivibrator.
- Describe the operation of bistable flip-flops.
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- Explain how rise time and the time constant affect flip-flop circuits.
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- Explain how IC pairs of one-shots or IC op amps form an astable multivibrator.
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- Discuss the composition of waveforms and explain how filters change the shapes of waveforms.
- Compare the frequency characteristics of low-pass and high-pass filters and of band-pass and band-reject filters.
- Discuss the calculation of time constants in timing circuits.
- Describe methods of creating and shaping complex waveforms, including the differentiator and integrator circuits.
- Explain briefly how digital waveforms are generated with a microprocessor.
- Discuss the basic requirements of four kinds of equipment used to test oscillators.
- Describe good general practices in troubleshooting oscillator components and circuits.

- Describe the steps in tracing oscillator circuit operation and selecting test points for monitoring waveforms.
- Discuss the steps in troubleshooting multivibrators, one-shots, and flip-flops.
- Discuss troubleshooting methods for sequential logic circuits, including clocks.
- Discuss troubleshooting methods for frequency dividers and filters.

CLASS DURATION

80 hours