2018
EDUCATION
SCHEDULE OF CLASSES

Real World Education. Real World Application.
The International Association for Continuing Education and Training (IACET) approved and active status began in 2017. A renewal occurs every 5 years. This accreditation focuses on the quality of AGMA Education programs. IACET reviews all AGMA Education’s processes for planning and delivery of our courses. IACET focuses on ensuring that our courses are based on explicitly identified learning outcomes and the delivery of the learning outcomes is achieved. With this accreditation, our courses are eligible for Continuing Education Units (CEUs).

AGMA Education meets the standard requirements which includes:

<table>
<thead>
<tr>
<th>Category</th>
<th>Title</th>
<th>What does it mean?</th>
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</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>Continuing Education and Training Organization</td>
<td>We have a designated education and training group responsible for administering our programs</td>
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<tr>
<td>Category 2</td>
<td>Responsibility and Control</td>
<td>We have an established system for compliance with IACET Standards</td>
</tr>
<tr>
<td>Category 3</td>
<td>The Learning Environment and Support Systems</td>
<td>Our learning environments and support system reflects the intent/learning outcomes of the programs and the programs achieve the learning outcomes</td>
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<tr>
<td>Category 4</td>
<td>Learning Event Planning</td>
<td>We base our programs on identified needs of the target audiences</td>
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<tr>
<td>Category 5</td>
<td>Learning Outcomes</td>
<td>Learning outcomes are based on identified needs and they are clearly provided to learners</td>
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<tr>
<td>Category 6</td>
<td>Planning and Instructional Personnel</td>
<td>We have qualified personnel planning and conducting our programs</td>
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<tr>
<td>Category 7</td>
<td>Content and Instructional Methods</td>
<td>Our methods are appropriate for each program</td>
</tr>
<tr>
<td>Category 8</td>
<td>Assessment of Learning Outcomes</td>
<td>We have established methods to assess achievement of learning outcomes</td>
</tr>
<tr>
<td>Category 9</td>
<td>Awarding CEUs and Maintaining Learner Records</td>
<td>We have established methods to award CEUs and a system to maintain, protect and provide training records</td>
</tr>
<tr>
<td>Category 10</td>
<td>Program Evaluation</td>
<td>We systematically evaluate all learning events and content to ensure we are providing the best possible learning experience</td>
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Continuing education units (CEUs) are calculated based on the number of minutes for instruction, accrediting organizations calculate CE differently. Non-instructional portions of an activity are not considered learning time and, therefore, are not added to instructional minutes. 1 CEU is equal to 10 hours. The learning activities allowed to receive CEU awards are face-to-face classes, distance courses, self-paced courses, and other projects in support of learning outcomes. Partial credit or adjusted CEUs shall not be awarded for individuals who do not successfully meet the criteria for achievement of CEUs.

0.1 CEU is based on 60 minutes of instruction. CEUs are expressed in tenths. The CEU is defined as 10 contact hours in an organized continuing education activity. The minimum number of CEUs awarded is 0.1.

If the resulting calculation ends in .5 or higher, round up to the nearest whole number.

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<tr>
<th>Calculation</th>
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<tr>
<td>1 hour plus 20 minutes</td>
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<tr>
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<tr>
<td>2 hours and 40 minutes</td>
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Learner Support

Need detailed information on courses? Have a question about the certificate program requirements?

We are here to provide learner support services to assist you in achieving your professional development goals and objectives. Please contact us at education@agma.org to discuss your educational needs.
AGMA places exceptional value on our members and non-members participation in our program offerings. The education department will continue to conduct programs that support the professional development of the gear manufacturing workforce that, in turn, will enhance the manufacturing and distribution of AGMA member company products. Offering courses in face-to-face, online, and webinar formats, we strive to be a leader in gear education and training and embrace the expanded use of technology to reach our learners anytime, anywhere. We are committed to providing relevant, cutting edge, and challenging learning opportunities with an emphasis on learning outcomes and the application of knowledge to meet employer and learner needs.

Our goals are to:

- Deliver training and education opportunities that build a knowledgeable, skilled workforce to more effectively and efficiently meet critical goals.
- Continually enhance the quality of the learning environment and the diversity of learning approaches to meet the needs of learners.
- Ensure that learning opportunities remain relevant.
- Continually assess and improve courses to assure desired learning outcomes are met.
- Attract, develop, and retain highly qualified, diverse instructors who are committed to our mission, who create a learning environment which is supportive and challenging, and who value service to others.

AGMA has established policies on:

- Student Record/Information Privacy
- Anti-Harassment/Discrimination
- Intellectual Property
- Proprietary Interest

For detailed information on such policies, please contact the education department at: education@agma.org.

AGMA Certificate Programs

A leader in Gear Education, AGMA continues to expand course offerings to meet the needs of the gear industry. Learners engage in professional development training by completing courses to earn the Advanced Gear Engineering Certificate and the Gear Manufacturing Certificate. It is quite an achievement and demonstrates a high level of commitment.

AGMA has expanded the certificate offerings to include the following:

**Advanced Gear Engineering Certificate**
- Any combination of five advanced courses

**Gear Manufacturing Certificate**
- Basic Training for Gear Manufacturing
- Fundamentals of Gear Design and Analysis
- Gear Manufacturing and Inspection
- 2 additional courses

More than 3,000 individuals have completed courses through AGMAs Education Department. Our industry leaders are committed to assisting their employees in gaining valuable knowledge and insight in order to retain a qualified and skilled workforce by making these training opportunities available. For these dedicated individuals, taking the series of classes consists of more than 90 hours of classroom instruction.
Instructor: Dwight Smith, Peter Grossi, and Allen Bird

Fee: $1,495 First registrant per member company | $1,295 additional registrant
$1,995 First registrant non-member company | $1,795 additional registrant

Learn the fundamentals of gear manufacturing in this hands-on course. Gain an understanding of gearing and nomenclature, principles of inspection, gear manufacturing methods, and hobbing and shaping. Utilizing manual machines, develop a deeper breadth of perspective and understanding of the process and physics of making a gear as well as the ability to apply this knowledge in working with CNC equipment commonly in use.

This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:
- Demonstrate understanding of the evolution, history, and function of gears
- Show and describe 14 gear tooth features
- Describe six typical gear characteristics that are measured
- Demonstrate knowledge of gauging vs. measurement
- Utilize and describe a variety of analysis methods
- Troubleshoot many of their own problems, because they fully understand the process

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Instructor: William "Mark" McVea, PhD

Fee: $1,495 First registrant per member company | $1,295 additional registrant
$1,995 First registrant non-member company | $1,795 additional registrant

Gain a solid and fundamental understanding of gear geometry, types and arrangements, and design principles. Starting with the basic definitions of gears, conjugate motion, and the Laws of Gearing, learn the tools needed to understand the inter-relation and coordinated motion operating within gear pairs and multi-gear trains. Basic gear system design process and gear measurement and inspection techniques will also be explained. In addition, the fundamentals of understanding the step-wise process of working through the iterative design process required to generate a gear pair will be reviewed. Learn the steps and issues involved in design refinement and some manufacturing considerations. An explanation of basic gear measurement techniques, how measurement equipment and test machines implement these techniques, and how to interpret the results from these basic measurements will also be covered.

Learning Objectives:
- Describe the measurement and inspection techniques used to qualify a gear
- Explain the major contributing factors to gear quality
- Describe, in detail, the practical gear measurement and inspection techniques
- Categorize the common tools and equipment used to measure and inspect gears
- Discuss some of the new and automated gear design systems

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ADVANCED LEVEL COURSE OFFERINGS

Gearbox System Design
2.0 CEUs
January 23–25, 2018
Las Vegas, NV

Instructor: Raymond J. Drago and Steve Cymbala

Fees:
$1,895 First registrant per member company | $1,695 additional registrant
$2,395 First registrant per non-member company | $2,195 additional registrant

This course focuses the supporting elements of a gearbox that allow gears and bearings to do their jobs most efficiently. Learn about seals, lubrication, lubricants, housings, breathers, and other details that go into designing gearbox systems.

Learning Objectives:
Upon completion, you will be able to:
• Understand types of housing construction, housing elements (covers, inspection ports, sump, mounting, etc.)
• Apply drawing practices for housings and related components
• Bearing mounting, retention and sealing
• Understand election and role of gearbox accessories, such as breathers, filters, screens, sight gages, and other level indication devices
• Apply the appropriate lubricant selection
• Apply the lubricant to the rotating elements
• Describe the selection criteria concerning the basic lubricant chemistry. Since the best design is only as good as its implementation, drawing practices and tolerancing will also be addressed from the designers' perspective.
• Learn about translating the general design from the design manual to the individual component drawings. Understand types of housing, construction, and housing elements

Gear Materials, Selection, Metallurgy
2.0 CEUs
February 5–7, 2018
Clearwater Beach, FL

Instructors: Raymond J. Drago and Roy Cunningham

Fee:
$1,895 First registrant per member company | $1,695 additional registrant
$2,395 First registrant non-member company | $2,195 additional registrant

This course addresses the various types of materials used for gears and the advantages and disadvantages of specific material choices. Heat treatment processes and their relation to gear performance, cost, reliability, and load characteristics are examined as well as best practice for engineer drawings related to the materials selection process. Learn the roles of the gear design engineer and the gear metallurgist from two instructors (who have worked together for 40 years) and how collaborative efforts can provide better outcomes. Discover how both the gear design engineer and the gear metallurgist can better grasp their related, critical roles in the exciting world of gear processing, heat treatment, and inspection.

Learning Objectives:
Upon completion, you will be able to:
• Describe the advantages and disadvantages of the various gear material choices, including steel, cast iron, ductile iron, plastics, bronze, and more exotic choices.
• Explain heat treatment processes and their relation to gear performance, cost, reliability, and load characteristics.
• Apply best practice for engine drawings to define and control the material selection process in an unambiguous, clear and complete manner.
• Identify the five important areas of the engineering drawing the metallurgist should look for.
• Use the proper nomenclature for gear materials.
• Describe typical heat treatment processing technique for gear materials.
• Explain why the metallurgist should review the manufacturing process sequence and list what he should look for.
• Discuss the types of grinding burns and how to prevent them from occurring.
**Gearbox CSI**  
**2.0 CEUs**  
**March 20–22, 2018**  
**Concordville, PA**

Instructors: Raymond J. Drago and Joseph W. Lenski, Jr.

**Fee:**  
$1,895 First registrant per member company | $1,695 additional registrant  
$2,395 First registrant non-member company | $2,195 additional registrant

Gain a better understanding of various types of gears and bearings. Learn about the limitation and capabilities of rolling element bearings and the gears that they support. Grasp and understanding of how to properly apply the best gear-bearing combination to any gearbox from simple to complex.

**Learning Objectives:**  
Upon completion, you will be able to:  
- Apply understanding of forensic analysis of gearbox failures in future gearbox designs  
- Discuss bearing and gear types  
- Explain how bearing selection is influenced by gear type and loading  
- Select appropriate bearing types and configurations as influenced by gear type and loading  
- Explain how to optimize bearing and gear combination  
- Identify seven materials and manufacturing related defects

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**Detailed Gear Design**  
**2.0 CEUs**  
**May 8–10, 2018**  
**Detroit, MI**

Instructor: Raymond J. Drago

**Fee:**  
$1,895 First registrant per member company | $1,695 additional registrant  
$2,395 First registrant non-member company | $2,195 additional registrant

This course explores all factors going into good gear design from life cycle, load, torque, tooth optimization, and evaluating consequences. An in-depth discussion of real-life gear failures is provided. Students should have a good understanding of basic gear theory and nomenclature.

**Learning Objectives:**  
Upon completion, you will be able to:  
- Improve their gear designs  
- Apply their understanding of gear rating theory and analysis methods  
- Investigate differences in stress states among various surface durability failure modes  
- Discuss time dependent and time independent failure modes related to tooth design  
- Use computer generated graphics to examine mesh action and tooth interaction  
- Discuss the concepts presented

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**2018 Annual Meeting**  
**April 26–28 | NAPLES, FL**

The 2018 Annual Meeting combines the expert knowledge of the gear and bearing industries with the latest emerging technologies that influence manufacturers and suppliers. From “crowd-based capitalism” to advanced powertrain technology reports, you will have the chance to join over 300 of your peers to experience an information-packed week full of top-tier speakers.

*Complete information available at [www.AGMA.org](http://www.AGMA.org)*
Instructor: Robert Bundy and Andrew Milburn

**Fee:**
$1,895 First registrant per member company | $1,695 additional registrant
$2,395 First registrant non-member company | $2,195 additional registrant

Explore gear failure analysis in this hands-on seminar where students not only see slides of failed gears but can hold and examine those same field samples close up. Experience the use of microscope and take your own contact pattern from field samples.

**Learning Objectives:**
After attending this session, you will be able to:
- Identify the primary and secondary failure modes
- Use the proper nomenclature to describe the morphology of gear failure
- Diagnose the root causes of failure
- Prescribe remedies to prevent repeat failures
- Use the GEARTECH textbook and other provided resources for ongoing study of gear failure analysis
- Tailor failure analysis techniques for their specific requirements

Instructor: Raymond J. Drago

**Fee:**
$1,495 First registrant per member company | $1,295 additional registrant
$1,995 First registrant per non-member company | $1795 additional registrant

Learn key factors in the inspection process that lead to better design of gears. Develop a broad understanding of the methods used to manufacture and inspect gears. Discover how the resultant information can be applied and interpreted in the design process.

**Learning Objectives:**
- Identify methods of manufacturing external and internal spur, single and double helical, and bevel and worm gears.
- Describe the methodology and underlying theory for basic manufacture and inspection of each.
- Discuss the “features” associated with each manufacturing method with regard to their impact upon and their ability to refine, guide and optimize the design process.
- Take two views of the same results: meeting a “specification” and determining acceptability for a specific application, and interpreting the inspection data for purposes other than simply determining accept/reject status.
- Specify the data required to control both the manufacturing and inspection processes on an engineering drawing. This includes both the data to be defined and the presentation of the data on the engineering drawing.
- Discuss the basics of a variety of destructive and nondestructive inspection tests, including their underlying theory, application techniques and, most importantly, interpretation of the resultant data.

**ACCREDITED IACET PROVIDER**
Instructor: Raymond J. Drago

Fee:
$1,695 First registrant per member company | $1,495 additional registrant
$2,195 First registrant non-member company | $1,995 additional registrant

Learn and define the concept of epicyclic gearing including some basic history and the differences among simple planetary gear systems, compound planetary gear systems and star drive gear systems. Cover concepts on the arrangement of the individual components including the carrier, sun, planet, ring and star gears and the rigid requirements for the system to perform properly. Critical factors such as load sharing among the planet or star gears, sequential loading, equal planet/star spacing, relations among the numbers of teeth on each element, calculation of the maximum and optimum number of planet/star gears for a specific system will be covered. Provides an in-depth discussion of the methodology by which noise and vibration may be optimized for such systems and load sharing guidelines for planet load sharing.

Learning Objectives:
• Restate exactly makes a gear system an epicyclic system
• Calculate the total reduction ratio of an epicyclic system and that of a star system.
• Identify differences and similarities between split power systems and true epicyclic systems.
• Recognize when the use of a star drive system is preferred over a planetary system.
• Understand the importance of equal planet/star gear spacing and how a system be designed with unequal planet spacing.
• Interpret how the numbers of teeth selected for the individual gears in an epicyclic or star drive gear system affect the noise and vibration characteristics of the system.
• Identify are the advantages of selecting odd numbers of teeth for the planet/star gears?
• Evaluate the numbers of teeth on the sun, planet and internal ring gear not arbitrary and what are the relations that must be maintained among these tooth numbers and why
• Explain how does the design of the carrier affect the overall performance of these complex systems
• Determine how does input speed affect the design of an epicyclic system and why are the speed concerns different for epicyclic and star drive systems
• Restate how the selection of the “fixed” member in a planetary system affect the ratio and relative rotation directions of the input and output shafts?
• Understand the design and use of load balancing systems including floating sun gears, and floating ring gears.
• Understand the differences between flexible and a rigid carrier design approaches.

Fundamentals of Worm & Crossed Axial Helical Gearing
1.3 CEUs
September 20-21, 2018
Alexandria, VA

Instructor: William “Mark” McVea, PhD

Fee:
$1,195 First registrant per member company | $995 additional registrant
$1,695 First registrant non-member company | $1,495 additional registrant

Provides an introduction and emphasize the differences between parallel (the experience base) axis and worm and crossed axis helical gears. Describe the basics of worm and crossed axis helical gears, their fundamental design principals, application guidelines and recommendations, lubrication requirement, a discussion of accuracy and quality and summarize with a brief review of common failure modes.

Learning Objectives:
After attending this session, you will be able to:
• Define the basic differences between parallel axis, common crossed intersecting axis and worm / wheel and crossed axis helical gears
• Interpret and discuss the design and applications specifics as they apply to worm / wheel and crossed axis helical gears
• Assess lubrication, cooling and support requirements for worm / wheel and crossed axis helical gears
• Explain the cause of a particular failure of a worm / wheel or crossed axis helical gear pair, as a function of application or use

Complete details are available at www.AGMA.org
Instructor: Lily Kamjou

Fee:
$1,495 First registrant per member company | $1,295 additional registrant
$1,995 First registrant per non-member company | $1,795 additional registrant

Learn to make use of steel properties in a system solution and understand the potential that different steel options can offer for their various applications. Explore how performance of the material and thus the component and system depends on how the steel is produced.

Learning Objectives:
- Describe how material properties affect the performance of their applications
- Apply their understanding of steel properties in an application
- Have a broader knowledge base to support choosing materials suited to application requirements
- Discuss how to verify and specify required steel properties
- Describe and apply the concepts presented

The development of AGMAs Workforce Education Series, Online Video Training Courses, Detailed Gear Design, Gearbox CSI, and the 2017 Webinar series are made possible through the generous support of the AGMA Foundation. Thank you for your continued support and partnership in educating the industry.

The AGMA Foundation also awards annual scholarships at the undergraduate and graduate school levels. In fact, 86% of the scholarship recipients have embarked on careers in gear manufacturing and design.

Contact Cindy Bennett, Executive Director, at bennett@agma.org for more information and how you can participate in the annual campaign.
Can’t make a live session? We bring the experts to you!

Online learning proves to be a great alternative to attending a face-to-face course. It is cost-effective and allows you to work at your own pace - anytime and anywhere. Learn the basics of the gear industry through the Online Workforce Education series and other advanced topics through the Online Video Training courses and Webinars.

The three-module Online Workforce Education series provides a basic overview for those new to the industry or for individuals that work in areas outside of engineering. In addition, those who work in human resources and/or sales also benefit from this series.

### Online Video Training Courses

- **Detailed Gear Design**
  
  Students can get the full experience of the course through more than 19 hours of video and supporting training documents. Learn about gear design and examine carefully crafted “problems” that will demonstrate the practical application of the optimization methods presented in this seminar. This course is facilitated by gear expert, Raymond Drago, P.E., of Drive Systems Technology, Inc.

  Member Fee: $1,095 / Non-member Fee: $1,595

- **Gear Failure Analysis**
  
  Students get the experience of the course through 10 hours of in-depth discussion of gear failure modes and supporting training documents. Learn the causes of gear failure and how to prevent it from occurring. You will also examine the various types of gear failure, such as overload, bending fatigue, Hertzian fatigue, wear, scuffing and cracking. Possible causes of these failures will be presented, along with some suggested ways to avoid them. This course is facilitated by expert gear failure analyst, Robert Errichello, P.E., of GEARTECH.

  Member Fee: $995 / Non-member Fee: $1,495

- **Gearbox CSI: Gears Only**
  
  This webinar focuses on the gear part of the Forensic Analysis of Bearings and Gear course. It helps gear designers gain a better understanding of various types of gears. This is a four-part series where you will learn about properly applying the best gear-bearing combination to any gearbox, simple or complex.

  Member Fee: $795 / Non-member Fee: $1,295

### Workforce Training Series

- **Member Fee: $0**
  
  This series, free for AGMA members, provides a comprehensive overview of gearing to enhance students’ understanding of essential terminology and practices within the industry. These are available to view for 60 days.

- **Fundamentals of Gearing**
  
  This course is a comprehensive overview of the industry. It begins with a little history of gearing and proceeds through the topics of parallel axis gear basics; involute tooth form; description of the gear; diametrical pitch/module; pitch; and pressure angle.

- **Parallel Gear Inspection**
  
  The gear inspection module includes basic concepts for gear measurement, the tools and instruments used, the evaluation of gear characteristics, definitions of terms, and introduction to gear classification.

### Webinars

- **Member Fee: $0**

  AGMA continues to provide top-quality education products to members of the gear industry. Sign up for a live webinar, or view one of the previously presented webinars. Watch it independently or with your entire staff!

  **For Live Webinars**
  
  Webinars are broadcast over the internet and sound is available either through your device speakers or audio on your phone. A toll-free number will be provided for each event. The log-in information is sent out several days prior to the event. Testing of your computer connection prior to the event is suggested and instructions will be provided with the login information. Free technical support is available.

  **For Previously Recorded Webinars**
  
  All sessions are recorded and sessions and handouts are available to view for 30 days.
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<tr>
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<tr>
<td><strong>Epicyclic Gear Systems: Application, Design &amp; Analysis</strong></td>
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<td><strong>Steels for Gear Applications</strong></td>
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<tr>
<th>ADDITIONAL EDUCATIONAL MERCHANDISE</th>
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<tr>
<td>Gear Failure Seminar Manual Digital Download (limited printing)</td>
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<tr>
<td>AGMA Member $350</td>
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<tr>
<td><strong>Gear Failure Atlas</strong></td>
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<td><strong>Geartech Handbook CD-ROM</strong></td>
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<td><strong>Geartech Handbook</strong></td>
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Shipping is included for U.S./Canada orders. For international orders, please contact broom@AGMA.org.

**PAYMENT METHOD**

- Check
- Credit Card (Visa, MasterCard, AmEx)

Number: ________________________
Expiration Date: (mm/yyyy): ________________________
CVV: ________________________

**TOTAL AMOUNT DUE:**

Signature: ________________________

**SPECIAL ARRANGEMENTS FOR EDUCATION EVENTS**

- Check here if you need special arrangements or accommodations and AGMA will contact you.

Dietary Restrictions: ________________________

Payment must accompany this form. All cancellations must be in writing and received by AGMA 14 days prior to the class start. A $200 U.S. processing fee will be assessed for each cancelled registration that results in a refund after that 14-day period. A substitution or schedule change fee of $50 when substituting one student for another or moving the current student to another AGMA course after the 14-day period. A 50% refund will be issued if cancellation occurs on or after the class start date.