Course Description
While function and rating are important factors in a successful gear design, to be truly optimal and successful, the gear designer must also design the gears to be manufactured and inspected. In this course, therefore, we will address key factors in a wide variety of manufacturing and inspection processes to enable the gear designer to better design optimal gears considering both rating and the necessary manufacturing and inspection processes to produce the gears as designed. We will also help the designer to understand how to interpret inspection data so that they can ensure that the gears meet the design. To be clear, this is not a course in how to operate the various machines. Rather it addresses the design provisions that are required to allow the gears to be optimally manufactured and inspected. The learner will develop a broad understanding of the methods used to manufacture and inspect gears, as well as interpret how the resultant information can be applied and interpreted in the design process.

It is recommended that you spend a minimum of 1 hour reading and reviewing the material each day.

Course Rationale/Students Course Designed to Serve
Design, manufacturing and quality control engineers involved with design, manufacture and inspection of gears and gearbox systems.

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 regarding 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.

Required Textbooks (Provided by AGMA)
AGMA’s Gear Manufacturing & Inspection: Methods, Practices, Application & Interpretation for the Design Engineer, by Raymond J. Drago., P. E.
COURSE OUTLINE

I. SUMMARY OF GEAR MANUFACTURING PROCESS
   a. Generating
   b. Forming
   c. Non-controlled

II. GENERATING PROCESSES
   a. Hobbing
      Rack Tooth Form
      Gang Hobbing
      Special Hops for Internal Gears
      Hobbing Spiral Bevel Gears
   b. Shaping
      Stroke
      Continuous
      Wafer Cutters
   c. Gear Planning
      Rack Cutters
      CBN Hard Cutting
      Backer Bars
   d. Face Milling
   e. Skiving
   f. Generating Grinding
   g. Roll Forming
   h. Disk Milling
   i. Hobbing
   j. Shaping – Pinion Shaped Tool
   k. Disk Cutter
   l. Shaping
   m. Continuous Rack Shaping
   n. Special Purpose Machines
      • Face Milling Spiral Bevel Gears
   p. Face Hobbing Spiral Bevel Gears
   q. Skiving With Carbide Hob
   r. Hard Finishing Bevel Gears
   s. Generating Grinding Parallel Axis Gears
      • Conical Wheel
      • Saucer Shaped Wheel
      • Threaded Wheel
   t. Generating Grinding Bevel Gears
   u. Bevel Gear Planning
   v. Bevel Gear Planning Generator
   w. Two Tool Generator – Straight Bevel Gears
   x. Roll Forming
      • Parallel Axis Gears
      • Worm Gears
   y. Roll Finishing A. Gear Manufacturing
   z. Generating Straight Bevel Gears With Disk Tools
      • Cutting
      • Grinding

III. FORMING PROCESSES
   a. Form Milling
   b. Slotting
   c. Gashing
   d. Form Grinding
      • Aluminum Oxide
      • CBN
   e. Broaching
   f. Shearing
   g. Forging
      • Net Shape
      • Near Net Shape
      • Powder Processes
      • Die Casting
      • Injection Molding
      • Extrusion
      • Stamping
      • Flame Cutting
      • Electrical Discharge Machining
      • Photo Chemical Machining

INSPECTION

I. PURPOSES
   a. Accept/Reject
   b. Determine Acceptability for Application

II. TYPES OF INSPECTION

III. GEOMETRIC
   a. Chart Identification & Part Orientation
   b. Use and Interpretation of AGMA quality numbers

IV. ELEMENTAL
   a. Involute Profile
   b. Lead
   c. Tooth Spacing
   d. Runout
   e. Tooth Thickness
   f. Surface Finish
STUDENT FEEDBACK AND GRADING PROCEDURES

Assignments
Assignments and learning activities are given and directed at the discretion of the instructor.

COURSE MANAGEMENT

Weather Delays and Cancelations
We will communicate any cancellations, delays or other concerns for safety prior to class via email, voicemail, and/or text message. Please be sure that we have all pertinent contact information as you travel to your class location.

Attendance for Domestic and International Students
Please be mindful that these are short, accelerated courses. Attendance is extremely important. If you are going to be absent from any class day, please contact the course coordinator. Rosemarie Bundoc, Education Manager, bundoc@agma.org or Stephanie Smialek, Education Coordinator, smialek@agma.org.

Plagiarism, Cheating and other types of Misconduct
Plagiarism¹, cheating and other types of misconduct are unacceptable.

Students with Disabilities
Students requiring assistance and accommodation should complete the Special Accommodation Request form and submit it to Stephanie Smialek, Education Coordinator, at smialek@agma.org. She can be reached at 703-838-0069.

Grievance Procedures
Students who have concerns about the class are encouraged to contact Stephanie Smialek, Education Coordinator, at smialek@agma.org or 703-838-0069.

Outline Changes
The instructor reserves the right to modify the outline during the course of the class.

LEARNING AND OTHER RESOURCES

Links for writing resources:
- grammar.ccc.commnet.edu/grammar
- www.merriam-webster.com

Links for Math resources:
- www.sosmath.com
- Khan Academy on www.youtube.com

Links for time management, study skills and note taking resources:
- www.mindtools.com
- www.testakingtips.com

¹ Plagiarism is defined as “the use or close imitation of the language and thoughts of another author and the representation of them as one’s own original work.”
Links for career resources:
  • https://www.agma.org/newsroom/jobs/

Industry News:
  • https://www.agma.org/newsroom/industry-news/