MechSigma GD&T Course Topics - ASME Y14.5-2009

Module 1: Introduction and Terms
- What is GD&T?
- How do we reference it?
- Why do we use GD&T?
- How does GD&T work?
- Diameters
- Dimensions and tolerances
- Reference dimensions
- Basic dimensions
- Methods to identify basic dimensions
- Feature of size
  - Regular feature of size
  - Irregular feature of size
- Non-size feature

Module 2: Symbols and Feature Control Frames
- Why do we use symbols?
- Radius tolerances
- Controlled radius
- Spherical radius
- Square symbol
- "Statistical Tolerance" symbol
- Documenting statistical tolerances
- Dimension origin symbol
- Geometric controls
- Repetitive features
- Feature control frame placement
- Screw threads
- Gears and splines

Module 3: Fundamental Rules and General Tolerancing Applications
- Application of tolerances
- Fundamental rules
- Nonrigid parts
- Specifying restraint
- Free state
- Tolerance rules
- Interpretation of limits
- Metric limits and fits
- Slotted holes
- Counterbores/countersinks
- Counterdrilled holes
- Spotfaces
- Angular surfaces
- Conical taper / flat taper

Module 4: Form Controls
- How to apply them
- Rule 1: Perfect form at MMC
- Nullifying rule 1
- Exceptions to rule 1
- Straightness tolerance for line elements
- Straightness tolerance for cylinders
  - Applied regardless of feature size (RFS)
  - Applied at maximum material condition (MMC)
  - Applied at least material condition (LMC)
- Flatness tolerance for a single planar feature
- Flatness tolerance for a width-type feature
- Circularity tolerance
- Cylindricity tolerance
- Circularity or cylindricity tolerance with average diameter
- Applied over a limited length/area
- Applied on a unit basis
- When do we use form tolerances?

Module 5: Datuming (Part 1)
- What is a datum?
- Datum feature
- Datum feature symbol application
- Establishing datums
- Datum reference frame (DRF) and three mutually-perpendicular planes
- Datums not at 90 degrees
- Degrees of Freedom
- Datum targets
  - Symbol
  - Identification
- Target applications
- Moveable datum targets
- Selecting the best datum targets

Module 6: Orientation Controls
- How to apply them
- Tolerance zones for planar features
  - Parallelism
  - Perpendicularity
  - Angularity
- Applied to a planar feature (including tangent plane application)
- Applied to line elements
- Angular (wedge shaped) tolerance zones
- Applied to cylindrical features (RFS)
- Applied to width-type features (RFS)
- Application of orientation tolerances
- Replacing perpendicularity and parallelism symbols with angularity symbol

Module 7: Features of Size
- Material conditions
  - Regardless of feature size
    - Internal feature RFS
    - External feature RFS
  - Maximum material condition
    - Internal feature at MMC
    - External feature at MMC
    - Straightness at MMC
  - Least material condition
    - Straightness applied to an internal feature at MMC
    - Straightness applied to an external feature at MMC
- When to use each material condition modifier?
- MMC Virtual condition
  - Internal feature at MMC
  - External feature at MMC
  - When to calculate virtual condition
  - Zero perpendicularity at MMC
- LMC Virtual condition
  - Internal feature at LMC
  - External feature at LMC
- When do we use MMC and LMC virtual condition?
- Resultant condition
  - MMC resultant condition
  - LMC resultant condition

Module 8: Datuming (Part 2)
- Material boundaries
  - Regardless of material boundary (RMB)
  - Maximum material boundary (MMB)
  - Least material boundary (LMB)
- Internal feature of size at RMB
  - Primary / Secondary / Tertiary
- Translation modifier
- External feature of size at RMB
  - Primary / Secondary

- Internal feature of size at MMB
  - Primary / Secondary / Tertiary
- External feature of size at MMB
  - Primary / Secondary / Tertiary
- DRF displacement
- Simultaneous requirements
- Separate requirements
- Internal feature of size at LMB
  - Primary / Secondary / Tertiary
- External feature of size at LMB
  - Primary / Secondary
- Pattern of holes
- Mathematical surfaces
- Unstable datums
- Note to establish a DRF
- Specifying restraint
- Releasing degrees of freedom

Module 9: Position Control
- Plus/Minus tolerancing
- How does position tolerancing work?
- Minimum tolerance between features
- How to apply it?
- Methods for establishing true positions
- Width type features
- Establishing true positions for angled features
- Bi-directional position tolerancing
- Spherical tolerance zone
- Fixed fasteners
- Floating fasteners
- Position for coaxiality
- Virtual condition boundary for location
- Zero tolerance at MMC
- Composite position
  - PLTZF and FRTZF
  - Simultaneous requirements
  - Separate requirements
- Stacked single segment feature control frames
- Projected tolerance zone

Module 10: Runout Controls
- How to apply them
- Datums for runout tolerance
  - Single diameter
  - Coaxial features
  - Diameter and face features
- Circular runout
- Total runout
- When do we use runout tolerances?

Module 11: Profile Controls
- How to apply it
- Profile of a surface
- Profile tolerance zone
- Profile to control size and form
- Profile to control size, form and orientation
- Profile to control size, form, orientation and location
- Profile to control coplanarity
- Non-uniform tolerance zone
- Profile of a line
- Composite profile
- When do we use profile tolerances?

Module 12: Symmetry Controls
- How to apply them
- Concentricity
- Comparison of coaxial controls
- Symmetry

Note: Coverage of topics is based on the customization of each course.