Western Technical College

31804332 Applied Math - Tool

Course Outcome Summary

Course Information

Description	A continuation of mathematics for the machine tool trade. Topics include applied right triangle, trigonometry, dimensioning for numerical control, applied geometry, solid geometry, binary arithmetic, and bending metal applications. Machine Tool topics dealing with data from a cutting speed table and gearing with metric module system are also studied.
Instructional Level	Technical Diploma Courses
Total Credits	2.00

Textbooks

Mathematics for Machine Technology. 7th Edition. Copyright 2016. Smith, Robert D. Publisher: Cengage Learning. **ISBN-13**: 978-1-133-28145-0. Required.

Learner Supplies

Scientific calculator - $10-20. **Vendor:** Campus Shop. Required.

Core Abilities

1. **Apply mathematical concepts.**
2. **Demonstrate ability to think critically.**
3. **Demonstrate ability to value self and work ethically with others in a diverse population.**
4. **Transfer social and natural science theories into practical applications.**
5. **Use effective communication skills.**
6. **Use technology effectively.**

Course Competencies

1. Solve right triangle applications involving decimal degrees.

Learning Objectives

1.a. Apply the sine, cosine, or tangent ratios to set up equations.
1.b. Determine the sine, cosine, or tangent function for angles expressed in decimal degrees (five decimal places).
1.c. Given the value of the sine, cosine, or tangent ratio calculate the angle to the nearest tenth of a degree.
1.d. Apply the sine, cosine, or tangent ratio to do application exercises.
1.e. Use the cosecant, secant, or cotangent ratio to find the value of an angle to five decimal places.
1.f. Given the value of the cosecant, secant, or cotangent ratio calculate the angle to the nearest tenth of a degree.

2. Solve right triangle applications involving degrees, minutes, and seconds.

Learning Objectives

2.a. Convert angles measured in decimal degrees to angles measured in degrees, minutes, and seconds.
2.b. Convert angles measured in degrees, minutes, seconds to angles measured in decimal degrees.
2.c. Determine the sine, cosine, tangent, cosecant, secant, and cotangent of angles expressed in degrees and minutes to 5-place decimal values.
2.d. Determine the value of an angle for any trig ratio to the nearest minute.
2.e. Solve a right triangle when two sides are known.
2.f. Solve a right triangle when one side and one acute angle are known.
2.g. Use basic right triangle solving techniques to find the solution to application problems in the machine-tool industry. Such applications will include: sine bar and sine plates, tapers and bevels, distance between holes and V-slots, V-blocks, threaded wire lengths for checking dimensions, and angle cuts.

3. Solve complex machine tool applications.

Learning Objectives

3.a. Draw auxiliary lines where needed, to form right triangles to do machine tool applications.
3.b. Solve taper applications involving more than one right triangle.
3.c. Solve V-slot applications involving more than one right triangle.
3.d. Determine the required angular value for applications with a series of holes.
3.e. Compute the unknown length or unknown angle in machine tool applications involving two or more right triangles.

4. Tabulate the solution to oblique triangles.

Learning Objectives

4.a. Apply certain right triangle properties to oblique triangles.
4.b. Use the Pythagorean Property to develop the Sine Law.
4.c. Solve oblique triangle applications when two angles and one side is known.
4.d. Solve oblique triangle applications when two sides and an angle opposite one of the sides is known.
4.e. Learn conditions necessary to have two different solutions when given two sides and an angle opposite of the sides.
4.f. Apply the Cosine Law to solve applications involving oblique triangles.
4.g. Apply the Sine Law or Cosine Law to do machine shop applications.

5. Dimension engineering drawings using point-to-point two-axis systems.

Learning Objectives

5.a. Use graph paper to plot points.
5.b. Refer to a point on the Cartesian Coordinate plane and give the point coordinates.
5.c. Apply the absolute positioning techniques to dimension workpieces located on the vertical axis and off the vertical axis.
5.d. Apply incremental positioning techniques to dimension workpieces located on the vertical axis and off the vertical axis.
5.e. Apply both absolute and incremental positioning techniques to dimension workpieces with bolt circles.
5.f. Apply two-axis dimensioning techniques to the three-axis coordinate system.

6. Apply the geometric properties of angles, triangles, and polygon to solve machine shop applications.

Learning Objectives

6.a. Name angles of drawing in three different ways.
6.b. Identify angles as acute, obtuse, right, or straight.
6.c. Calculate the value of angles in drawings with parallel sides.
6.d. Determine unknown angles using the fact that all triangles have an angular sum of 180 degrees.
6.e. Identify the corresponding parts of similar triangles.
6.f. Use the fact that corresponding sides of similar triangles are proportional to calculate angular values in blueprints.
6.g. Apply the fact that two triangles are similar to find unknown lengths in triangles.
6.h. Determine the unknown interior angle for a polygon by using the formula for the sum of the interior angles of any polygon.

7. Apply geometric properties of circles to solve applications for the machine shop.

Learning Objectives

7.a. Name parts of a circle in machine shop layouts.
7.b. Use the circumference formula to calculate the unknown value in a circle.
7.c. Solve geometric drawings by applying the geometric principle that in the same circle two central angles have the same ratio as the arcs cut off by the angles.
7.d. Determine the unknown length in a drawing by using the fact that if two chords intersect inside a circle the product of the two parts of one chord is equal to the product of the two parts of the other chord.
7.e. Apply the geometric property for tangent lines to find unknown values in a circle.

8. Use geometric principles that deal with arcs and angles of a circle to compute solutions to application problems.

Learning Objectives

8.a. Solve application problems using the fact that an angle formed by two chords intersecting inside a circle is equal to one-half the sum of its intercepted arcs.
8.b. Compute the value for angles whose vertex is found on the circle
8.c. Use the arc length formula to find the length of arcs.
8.d. Solve application problems using the fact that an angle formed outside a circle by two secants, two tangents, or a secant and a tangent line is equal to one-half the difference of its intercepted arcs.
8.e. Use the geometric principle for two circles that are either externally or internally tangent to compute the unknown value in machine shop layouts.

9. Use additional topics of radian measure and bending metal to solve application problems.

Learning Objectives

9.a. Convert an angle measured in degrees and minutes to an angle measured in radians.
9.b. Convert an angle measured in radians to an angle measured in degrees and minutes.
9.c. Apply radian measure to find the involuate function for any angle (to 5-decimal places).
9.d. Use geometric principles to find the length of any piece of bended metal.

10. Compute the solution for applications involving compound angles.

Learning Objectives

10.a. Use the fact that the true length of a line shown where the line is contained in a plane viewed from the perpendicular line of sight to find the true length of a diagonal in a rectangular solid.
10.b. Apply basic trigonometry to calculate the angular value for the true angle of a diagonal in a rectangular solid.
10.c. Calculate the angle of rotation and the angle of tilt when the length, width, and height of the rectangular solid are known.
10.d. Compute the angles of rotation and tilt by first sketching and labeling the compound angular components within a rectangular solid.
10.e. Compute angles of rotation and tilt of holes axis in a rectangular solid when no length dimensions are known.
10.f. Determine the angles of rotation and tilt by using formulas.

11. Use a cutting speed table to calculate the machine's speed (in rpms) for various machine shop applications.

Learning Objectives

11.a. Apply the information obtained from a cutting speed table to do machine shop problems.
11.b. Use the appropriate formula for cutting speeds to do applications.

12. Use machine tool formulas to calculate belt lengths and various spur gear applications

Learning Objectives

12.a. Select the correct belt length formula to find the belt length for pulleys connected by either the open or closed belt pattern.
12.b. Select the correct module to aid in spur gear calculations.
12.c. Use the correct spur gear formula, along with the correct module from a metric, spur gear table to compute the value of various spur gear topics. Topics to include: pitch, pitch diameter, circular pitch, outside diameter addendum, whole depth, and working depth.