



**COWLEY COLLEGE  
& Area Vocational Technical School**

**COURSE PROCEDURE FOR**

**CNC OPERATIONS  
MTT3571 3 Credit Hours**

**Student Level:**

This course is open to students on the college level in either the freshman or sophomore year and to area high school vocational students.

**Catalog Description:**

**MTT 3571 - CNC OPERATIONS (3 hrs)**

This is a basic course in CNC programming using the HAAS, Cincinnati 850, O'Kuma L518 and the General Numeric (Fanuc) GN6 control. Instruction will cover basic CNC programming of a lathe and milling machine.

**Prerequisites:**

MTT3562 Machining II or instructor approval.

**Controlling Purpose:**

Students will become acquainted with the history of Numerical Control (NC) and Computer Numerical Control (CNC) machines and will be introduced to a CNC machine used in the precision machining trades. They will gain practical experience in the application of "G" codes and "M" codes, writing CNC machine programs, and machine setup and operation.

**Learner Outcomes:**

- A. Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses and cutting machines.
- B. Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings and shop sketches.
- C. Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking.
- D. Apply safety principles in a work environment to minimize hazards and prevent losses to productivity.
- E. Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.
- F. Use CAD and CAM programs to design parts and program manufacturing machines.

The learning outcomes and competencies detailed in this course outline or syllabus meet or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Groups project for this course as

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approved by the Kansas Board of Regents.

**Units Outcomes and Criterion Based Evaluation Key for Core Content:**

The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

- A = All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same field.
- B = All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.
- C = All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.
- D = A few of the major goals have been achieved, but the student’s achievement is so limited that he is not well prepared to work at a more advanced level in the same field.
- F = Failing, will be computed in GPA and hours attempted.
- N = No instruction or training in this area.

| <b>UNIT 1: Conduct Job Hazard Analysis For CNC Lathe And Mill</b>  |   |   |   |   |   |   |
|--|---|---|---|---|---|---|
| Outcomes: Upon completion of this course students will be able to demonstrate how to conduct a JHA for CNC Lathe and Mill. |   |   |   |   |   |   |
| A  | B | C | D | F | N | Specific Competencies   |
|  |   |   |   |   |   | Demonstrate the ability to:   |
|  |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity. |

**UNIT 2: Create Handwritten CNC Programs Using G And M Codes**

Outcomes: Upon completion of this course students will be able to demonstrate how to create a hand written CNC program using G and M codes. Students will create a name plate and one custom project for the mill and lathe.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking. |
|   |   |   |   |   |   | Use CAD and CAM programs to design parts and program manufacturing machines.                                      |

**UNIT 3: Perform Software Communications Between PC And CNC Equipment**

Outcomes: Upon completion of this course students will be able to demonstrate how to transfer programs from the PC to the CNC equipment.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking. |
|   |   |   |   |   |   | Use CAD and CAM programs to design parts and program manufacturing machines.                                      |

#### UNIT 4: Enter CNC Program Into Control

Outcomes: Upon completion of this course students will be able to demonstrate how to utilize the CNC controller.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines. |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.   |

#### UNIT 5: Enter Programs In MDI (Manual Data Input)

Outcomes: Upon completion of this course students will be able to demonstrate how to enter programs in MDI, tool changes, spindle speeds, and coolant on/off.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines. |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.   |

#### UNIT 6: Edit CNC Programs

Outcomes: Upon completion of this course students will be able to demonstrate how to find mistakes and edit the programs in the PC and in the CNC controller.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking. |
|   |   |   |   |   |   | Use CAD and CAM programs to design parts and program manufacturing machines.                                      |

**UNIT 7: Perform Sequence Search To Restart Or Edit Programs**

Outcomes: Upon completion of this course students will be able to demonstrate how to perform sequence search to restart or edit programs.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines. |
|   |   |   |   |   |   | Use CAD and CAM programs to design parts and program manufacturing machines.  |

**UNIT 8: Execute CNC Program Sequences From Zero Or Point Of Reference**

Outcomes: Upon completion of this course students will be able to demonstrate how to execute CNC program sequences from zero or point of reference.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines. |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.   |

**UNIT 9: Execute Emergency Stop And Restart Procedures**

Outcomes: Upon completion of this course students will be able to demonstrate how execute emergency stop and restart procedures.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines. |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.   |

**UNIT 10: Interrupt Automatic Cycle Mode Manually To Stop Potential Damage To Part and/or Machine**

Outcomes: Upon completion of this course students will be able to demonstrate how to interrupt automatic cycle mode manually to stop potential damage to material and/or machine.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity.  |

**UNIT 11: Orient Machine Axis With Holding Devices**

Outcomes: Upon completion of this course students will be able to demonstrate how to orient machine axis with holding devices.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity.  |

**UNIT 12: Thread Interior And Exterior Surfaces**

Outcomes: Upon completion of this course students will be able to demonstrate how to thread interior and exterior surfaces.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking.  |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity.  |

**UNIT 13: Determine Spindle Speed And Feed Rate**

Outcomes: Upon completion of this course students will be able to demonstrate how to determine spindle speed and feed rate by formulas provided.

| A | B | C | D | F | N | Specific Competencies   |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | Demonstrate the ability to:   |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking. |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity              |

**UNIT 14: Perform Facing Operations To Rough Or Finish Surfaces**

Outcomes: Upon completion of this course students will be able to demonstrate how to perform facing operations to rough or finish surfaces on a mill.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity   |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields.  |

**UNIT 15: Perform Turning Operations To Rough Or Finish A Surface**

Outcomes: Upon completion of this course students will be able to demonstrate how to perform turning operations to rough or finish a surface on a lathe.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity   |



**UNIT 16: Adjust Tool Offsets**

Outcomes: Upon completion of this course students will be able to demonstrate how to adjust tool offsets within the CNC.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |

**UNIT 17: Verify CNC Programs Prior To Executing Program Sequence**

Outcomes: Upon completion of this course students will be able to demonstrate how to verify CNC programs prior to running the program.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking.  |
|   |   |   |   |   |   | Use CAD and CAM programs to design parts and program manufacturing machines.   |

**UNIT 18: Bore Cylindrical Surfaces On CNC Equipment**

Outcomes: Upon completion of this course students will be able to demonstrate how to bore cylindrical surfaces on CNC equipment.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity   |

**UNIT 19: Power Up And Power Down CNC Machines**

Outcomes: Upon completion of this course students will be able to demonstrate how to power up and power down CNC machines.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Demonstrate employability skills needed to obtain and retain employment in machine tool and related fields   |

**UNIT 20: Plan CNC Machining Operations**

Outcomes: Upon completion of this course students will be able to demonstrate how to plan CNC machining operations.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking |

**UNIT 21: Adjust Cutter Compensation To Maintain Accuracy Of Cuts**

Outcomes: Upon completion of this course students will be able to demonstrate how to adjust cutter compensation to maintain accuracy of cuts.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity   |

## UNIT 22: Ream Holes To Specification With CNC Lathes And Mills

Outcomes: Upon completion of this course students will be able to demonstrate how to ream holes to specification with CNC lathes and mills.

| A | B | C | D | F | N | Specific Competencies  |
|---|---|---|---|---|---|--|
|   |   |   |   |   |   | Demonstrate the ability to:  |
|   |   |   |   |   |   | Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses, and cutting machines |
|   |   |   |   |   |   | Manufacture parts from various materials in accordance with specifications from blueprints, electronic drawings, and shop sketches.                              |
|   |   |   |   |   |   | Apply safety principles in a work environment to minimize hazards and prevent losses to productivity   |

### **Projects Required:**

As assigned

### **Textbook:**

Contact Bookstore for current textbook.

### **Materials/Equipment Required:**

None

### **Attendance Policy:**

Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

### **Grading Policy:**

The grading policy will be outlined by the instructor in the course syllabus.

### **Maximum class size:**

Based on classroom occupancy

### **Course Timeframe:**

The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time. The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

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**Refer to the following policies:**

[402.00 Academic Code of Conduct](#)

[263.00 Student Appeal of Course Grades](#)

[403.00 Student Code of Conduct](#)

**Disability Services Program:**

Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability, which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.