CNC Operations
Course Outcome Summary
Updated November 2022

Course Information
Total Credits 3

Description
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.

Prerequisites
OSHA 10 or 30 Safety Course
Machining I
Machining II

Exit Learning Outcomes
Program Outcomes
A. Operate machine tool equipment commonly found in industry including CNC Turning Centers, and CNC Vertical and Horizontal Machining Centers.
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 CNC machines

Competencies
1. Conduct job hazard analysis for CNC lathe and mill
   Properties
   Domain: Cognitive  Level: Application
   Linked Program Outcomes
   Apply safety principles in a work environment to minimize hazards and prevent losses to productivity

2. Create handwritten CNC programs using G and M codes
   Properties
   Domain: Cognitive  Level: Synthesis
   Linked Program Outcomes
   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
3. Perform software communications between PC and CNC equipment
   Properties
   Domain: Cognitive  Level: Application
   Linked Program Outcomes
   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

4. Enter CNC Program into control
   Properties
   Domain: Psychomotor  Level:
   Linked Program Outcomes
   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

5. Enter programs in MDI (manual data input)
   Properties
   Domain: Psychomotor  Level:
   Linked Program Outcomes
   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

6. Edit CNC programs
   Properties
   Domain: Cognitive  Level: Application
   Linked Program Outcomes
   Use CAD and CAM programs to design parts and program manufacturing machines
   Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking

7. Perform sequence search to restart or edit programs
   Properties
   Domain: Psychomotor
   Linked Program Outcomes
   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

8. Execute CNC program sequences from zero or point of reference
   Properties
   Domain: Cognitive  Level: Application
   Linked Program Outcomes
   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

9. Execute emergency stop and restart procedures
Properties
Domain: Cognitive  Level: Application

Linked Program Outcomes
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

10. **Interrupt automatic cycle mode manually to stop potential damage to part and/or machine**
    Properties
    Domain: Cognitive  Level: Application
    Linked Program Outcomes
    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

11. **Orient machine axis with holding devices**
    Properties
    Domain: Psychomotor  Level:
    Linked Program Outcomes
    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

12. **Thread interior and exterior surfaces**
    Properties
    Domain: Psychomotor
    Linked Program Outcomes
    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

13. **Determine spindle speed and feed rate**
    Properties
    Domain: Cognitive  Level: Application
    Linked Program Outcomes
    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
14. **Perform facing operations to rough or finish surfaces**
   
   **Properties**
   Domain: Psychomotor

   **Linked Program Outcomes**
   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

15. **Perform turning operations to rough or finish a surface**
   
   **Properties**
   Domain: Psychomotor

   **Linked Program Outcomes**
   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

16. **Adjust tool offsets**
   
   **Properties**
   Domain: Psychomotor

   **Linked Program Outcomes**
   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

17. **Verify CNC programs prior to executing program sequence**
   
   **Properties**
   Domain: Cognitive  Level: Evaluation

   **Linked Program Outcomes**
   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

18. **Bore cylindrical surfaces on CNC equipment**
   
   **Properties**
   Domain: Psychomotor  Level:

   **Linked Program Outcomes**
   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

19. **Power up and power down CNC machines**
   **Properties**
   Domain: Psychomotor
   **Linked Program Outcomes**
   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

20. **Plan CNC machining operations**
   **Properties**
   Domain: Cognitive  Level: Synthesis
   **Linked Program Outcomes**
   Solve quality problems using process planning, technical knowledge, teamwork, mathematics, and critical thinking

21. **Adjust cutter compensation to maintain accuracy of cuts**
   **Properties**
   Domain: Affective  Level: Organizing
   **Linked Program Outcomes**
   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

22. **Ream holes to specification with CNC lathes and mills**
   **Properties**
   Domain: Psychomotor  Level:
   **Linked Program Outcomes**
   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