8858
CNC Machines (12D)

40S/40E/40M

A Machining Technology Course

Interim

8858 CNC Machines (12D) 40S/40E/40M

Course Description

Students develop the skills and knowledge necessary to select, operate, and maintain tools, as well as perform calculations, interpret engineering drawings, perform work set-up, and cut materials in a safe, efficient, and responsible manner through work on practical projects related to CNC machining.

Goal 1: Demonstrate an understanding of and adherence to the **health and safety** practices that contribute to the **maintenance of a safe workplace**.

GLO 1.1: Demonstrate an understanding of and adherence to the **health and safety** practices that contribute to the **maintenance of a safe workplace**.

SLO 12D.1.1.1 Demonstrate an awareness of some of the long-term health concerns related to machining.

Goal 2: Demonstrate an understanding of and the ability to apply the transferable **cross-curricular knowledge and skills** (literacy, numeracy, the sciences, and information and communication technologies) that pertain to machining technology.

GLO 2.1: Demonstrate an understanding of and the ability to apply **literacy** knowledge and skills, including the terminology, abbreviations, symbols, and acronyms, that pertain to machining technology.

SLO 12D.2.1.1 Demonstrate an understanding of terminology, abbreviations, symbols, and acronyms associated with CNC (computer numerical control) machining.

SLO 12D.2.1.2 Demonstrate an understanding of and the ability to use Cartesian coordinates.

SLO 12D.2.1.3 Demonstrate an understanding of and the ability to use the acronyms *CAD, CAM,* and *CNC.*

GLO 2.2: Demonstrate an understanding of and the ability to apply **numeracy** knowledge and skills that pertain to machining technology.

SLO 12D.2.2.1 Demonstrate the knowledge and skills required to solve problems involving fractions and decimals.

SLO 12D.2.2.2 Demonstrate the knowledge and skills required to solve problems involving metric and imperial measure.

SLO 12D.2.2.3 Demonstrate the knowledge and skills required to solve problems involving length, perimeter, circumference, volume, area, mass, angles, ratio, and percentage.

SLO 12D.2.2.4 Demonstrate the knowledge and skills required to convert between imperial and metric measurements.

SLO 12D.2.2.5 Demonstrate the knowledge and skills required to use formulas to calculate data accurately for use in machining operations.

SLO 12D.2.2.6 Demonstrate the knowledge and skills required to accurately calculate and measure parts and angles.

SLO 12D.2.2.7 Demonstrate the knowledge and skills required to solve mathematical calculations, conversions, and measurements.

SLO 12D.2.2.8 Demonstrate the knowledge and skills required to use charts, reference books, and other resources to determine tap drill sizes.

SLO 12D.2.2.9 Demonstrate the knowledge and skills required to plot points using Cartesian coordinates.

SLO 12D.2.2.10 Demonstrate the knowledge and skills required to calculate accurately the RPM for CNC lathe and machining centres.

SLO 12D.2.2.11 Demonstrate the knowledge and skills required to calculate accurately the feed rate for CNC lathe and machining centres.

GLO 2.3: Demonstrate an understanding of and ability to apply the **scientific** knowledge and skills that pertain to machining technology, including those related to **metallurgy**.

SLO 12D.2.3.1 Demonstrate an understanding of the effects of cutting tools on different metals.

SLO 12D.2.3.2 Demonstrate an understanding of the physics involved in metal cutting.

SLO 12D.2.3.3 Demonstrate an understanding of heat treatment.

Goal 3: Demonstrate an understanding of **technical drawings**, including the ability to read, interpret, and create them.

GLO 3.1: Demonstrate an understanding of **technical drawings**, including the ability to read, interpret, and create them.

SLO 12D.3.1.1 Demonstrate the knowledge and skills required to produce basic paper-and-pencil sketches of projects.

SLO 12D.3.1.2 Interpret and extract information from drawings. (A6.3)

- lines
- projections
- dimensions
- notes
- lay/surface finish symbols
- welding symbols

SLO 12D.3.1.3 Demonstrate an understanding of the dimensions found on drawings.

SLO 12D.3.1.4 Demonstrate an understanding of the tolerances found on drawings.

Goal 4: Demonstrate **layout** and **planning** skills.

GLO 4.1: Demonstrate an understanding of and ability to use **planning and layout tools**, **equipment**, and **accessories**.

SLO 12D.4.1.1 Calculate layout dimensions and reference points. (A11.4)

SLO 12D.4.1.2 Demonstrate the knowledge and skills required to use planning worksheets.

GLO 4.2: Demonstrate an understanding of and ability to perform **layout on projects**.

SLO 12D.4.2.1 Perform basic layout. (A11.9)

GLO 4.3: Demonstrate **CNC (computer numerical control) planning skills**.

SLO 12D.4.3.1 Demonstrate an understanding of the datum or reference surfaces, their applications, and their advantages.

SLO 12D.4.3.2 Demonstrate the knowledge and skills required to use planning worksheets for projects.

SLO 12D.4.3.3 Demonstrate the knowledge and skills required to produce a basic CNC program for lathe and machining centres.

SLO 12D.4.3.4 Demonstrate the knowledge and skills required to plot Cartesian coordinates on graph paper.

Goal 5: Demonstrate the understanding and skills required to perform **measurement** and **quality control** procedures, using the appropriate tools.

GLO 5.1: Demonstrate the understanding and skills required to perform **measurement** and **quality control** procedures, using the appropriate tools.

SLO 12D.5.1.1	Demonstrate the knowledge and skills required to identify a coordinate measuring machine.
SLO 12D.5.1.2	Demonstrate the knowledge and skills required to identify surface finish with a surface comparator gauge.
SLO 12D.5.1.3	Demonstrate an understanding of the rework of CNC-machined parts.
SLO 12D.5.1.4	Demonstrate an understanding of the operation of a coordinate measuring machine.

Goal 6: Demonstrate an **understanding** of and the ability to **use**, **inspect**, **store**, and **maintain tools**, **equipment**, **accessories**, and **consumables**.

GLO 6.1: Demonstrate an **understanding** of **tools**, **equipment**, **accessories**, and **consumables**.

SLO 12D.6.1.1	Demonstrate an understanding of CNC machining centres and accessories.
SLO 12D.6.1.2	Demonstrate an understanding of various work-holding devices.

GLO 6.2: Demonstrate the knowledge and skills required to **use tools**, **equipment**, **accessories**, and **consumables**.

No applicable SLOs.

GLO 6.3: Demonstrate the knowledge and skills required to **inspect**, **maintain**, and **store tools**, **equipment**, **accessories**, and **consumables**.

SLO 12D.6.3.1	Demonstrate the skills required to inspect, store, and maintain tools, equipment, accessories, and consumables.

GLO 6.4: Demonstrate an understanding of and the ability to use **CAD (computer-aided design)/CAM (computer-aided manufacturing) software and CNC (computer numerical control) machines**.

SLO 12D.6.4.1	Demonstrate an understanding of and the ability to use CAD/CAM software and CNC machines.
SLO 12D.6.4.2	Demonstrate an understanding of hazards pertaining to CNC machine tools.
SLO 12D.6.4.3	Demonstrate an understanding of safe work practices pertaining to CNC machine tools.
SLO 12D.6.4.4	Adhere to all safe work practices pertaining to CNC machine tools.
SLO 12D.6.4.5	Demonstrate an understanding of CNC lathes and accessories.
SLO 12D.6.4.6	Demonstrate the knowledge and skills required to use CAD/CAM software to design parts.
SLO 12D.6.4.7	Demonstrate the knowledge and skills required to use CAD/CAM software to program parts.
SLO 12D.6.4.8	Demonstrate the knowledge and skills required to use CNC machines to manufacture parts.
SLO 12D.6.4.9	Demonstrate an understanding of the different levels of accuracy between a conventional machine tool with that of a CNC machine tool.
SLO 12D.6.4.10	Demonstrate an understanding of various types of CNC equipment (e.g., water jet, laser, plasma).
SLO 12D.6.4.11	Demonstrate the knowledge and skills required to prepare a manual CNC program for a milling machine.
SLO 12D.6.4.12	Demonstrate the knowledge and skills required to prepare a manual CNC program for a lathe.
SLO 12D.6.4.13	Demonstrate an understanding of the format of a CNC program.
SLO 12D.6.4.14	Demonstrate an understanding of the differences between G code and M code.
SLO 12D.6.4.15	Demonstrate an understanding of the term *tool path*.
SLO 12D.6.4.16	Demonstrate an understanding of the differences between incremental and absolute positioning.
SLO 12D.6.4.17	Demonstrate an understanding of the differences between linear and circular interpolation.

Goal 7: Demonstrate an understanding of the **scope** of machining technology (and associated occupations), including **working conditions**, and **training and career opportunities**.

GLO 7.1: Demonstrate an understanding of the scope of machining technology (along with associated occupations), including **working conditions**.

SLO 12D.7.1.1	Demonstrate an understanding of wages and salaries for machinists and workers in associated occupations.
SLO 12D.7.1.2	Demonstrate an understanding of the working conditions that are typical for machinists and those employed in associated occupations (e.g., standing for long periods of time, shift work, travel, repetitive strain disorder).
SLO 12D.7.1.3	Demonstrate an awareness of unions and industry groups associated with machining.

GLO 7.2: Demonstrate an understanding of **training and career opportunities** in machining technology and associated occupations.

SLO 12D.7.2.1	Demonstrate an understanding of the differences between machinist, CNC machinist, CNC operator, CNC programmer, and CNC set-up person.
SLO 12D.7.2.2	Demonstrate the knowledge and skills required to locate information about the various occupations specific to CNC.
SLO 12D.7.2.3	Demonstrate the knowledge and skills required to prepare and update a resumé to find employment in machining or associated occupations.
SLO 12D.7.2.4	Demonstrate an awareness of the need for machinists to continue learning and training after earning journeyperson certification.

Goal 8: Describe the **history** of, and **technological progressions** and **emerging trends** in, machining technology.

GLO 8.1: Describe the **history** of, and **technological progressions** and **emerging trends** in, machining technology.

SLO 12D.8.1.1	Demonstrate an understanding of the evolution of CNC machining, including technological progressions and emerging trends.

Goal 9: Demonstrate the **skills for success**.

GLO 9.1: Demonstrate fundamental **employability skills**.

SLO 12D.9.1.1 Demonstrate regular and punctual attendance.

SLO 12D.9.1.2 Demonstrate the ability to communicate respectfully and effectively.

SLO 12D.9.1.3 Demonstrate accountability by taking responsibility for own actions.

SLO 12D.9.1.4 Demonstrate adaptability, initiative, and effort.

SLO 12D.9.1.5 Demonstrate teamwork skills.

SLO 12D.9.1.6 Demonstrate the ability to stay on task and use time effectively.

SLO 12D.9.1.7 Demonstrate the responsible use of wireless devices.

SLO 12D.9.1.8 Demonstrate the ability to accept and follow directions and listen to feedback.

SLO 12D.9.1.9 Describe two levels of workplace competency (job and social) related to workplace culture. (A3.2)

- job competencies related to workplace culture:
  - knowledge of workplace equipment and materials
  - skills and techniques
- social competencies related to workplace culture:
  - frame of reference for evaluation workplace events
  - language of work
  - workplace belief systems
  - rules and meanings
  - multiculturalism and equity in the workplace

GLO 9.2: Demonstrate the knowledge, skills, and attitudes required to **think critically** in order to anticipate, troubleshoot, and solve complex problems.

No applicable SLOs.

GLO 9.3: Demonstrate an awareness of **culture** and **diversity**, and their importance in the workplace.

SLO 12D.9.3.1 Demonstrate an awareness of some of the culture-related issues and/or diversity-related issues in the machining industry, or in a typical workplace.

Goal 10: Demonstrate an awareness of **ethical** and **legal standards** as they pertain to machining technology.

GLO 10.1: Demonstrate an awareness of **ethical** and **legal standards** as they pertain to machining technology.

SLO 12D.10.1.1 Demonstrate an understanding of the relationship between ethics and employability skills, such as creating a respectful workplace and demonstrating a strong work ethic.

Goal 11: Demonstrate an awareness of **sustainability** as it pertains to machining technology.

GLO 11.1: Describe machining technology's **sustainability practices** and **impact on the environment**.

SLO 12D.11.1.1 Demonstrate an understanding of recycling, reduction of waste, and reuse of materials.

SLO 12D.11.1.2 Demonstrate an understanding of the disposal of coolants, oils, and non-recyclable waste.

GLO 11.2: Demonstrate an awareness of the **business sustainability** of a machining technology facility.

SLO 12D.11.2.1 Demonstrate an understanding of the contribution of employees to the sustainability of a business.