COURSE OUTLINE: MAC207 - CNC TURNING

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	MAC207: CNC TURNING TECHNOLOGY
Program Number: Name	6346: GENERAL MACHINIST L2
Department:	MECHANICAL TECHNIQUES PS
Semesters/Terms:	21W, 21F, 22W
Course Description:	This course is designed to provide Level II General Machinist Apprentices the ability to describe numerically controlled turning centre procedures and demonstrate procedures for entering and verifying CNC programs.
Total Credits:	5
Hours/Week:	3
Total Hours:	36
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
Other Course Evaluation & Assessment Requirements:	Other Course Evaluation Requirements: Smart watches, smart phones and similar devices are not allowed during tests or quizzes and must be removed. Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 - 59% 1.00 F (Fail)49% and below 0.00 CR (Credit) Credit for diploma requirements has been awarded. S Satisfactory achievement in field /clinical placement or non-graded subject area. U Unsatisfactory achievement in field/clinical placement or non-graded subject area. X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. NR Grade not reported to Registrar`s office. W Student has withdrawn from the course without academic penalty.
Books and Required Resources:	Technology Of Machine Tools by Steve F. Krar, Arthur R. Gill, Peter Smid, Robert J. Gerritsen Publisher: McGraw - Hill Edition: 8 ISBN: 9781260565782

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2020-2021 academic year.

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
1.Describe safe working procedures when setting up and operating CNC turning centres.	1.1 Identify potential safety hazards which may occur during CNC turning centre machine set-up and operating procedures. Demonstrate safe working habits including: - protective clothing - protective equipment and gear - good housekeeping - start-up procedures - shut-off procedures - securing tooling - securing accessories - stabilizing workpiece - securing workpiece - lock-out procedures
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2.Describe operating principles and applications of CNC turning centres. (1 hr)	2.1 Identify the capabilities of CNC turning centres: - types of equipment - editing capability - program path ability - processing power Describe CNC turning centre controls: - CNC controls - tapeless control - PC/DNC systems Describe features and functions of turning centres: - CPU - input devices - turret - work envelope - holding devices - alarms - safety interlock Describe the major features of a CNC manufacturing process: - engineering drawing - CNC part program - input media - CNC machine tool - finished part - repeatability
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3.Describe the basics of CNC dimensioning.(1.5 hrs)	3.1 Describe the Cartesian Coordinate System:

	- quadrant notation - point location in XZ plane Describe machine tool axis designations: - primary linear axis - secondary linear axis - axis orientation Identify types of machine zero point locations: - fixed zero points -full zero shift - floating zero Determine set-up point locations by determining: - machine home position - absolute zero position - Z axis touch-off points Describe the capabilities of positioning and contouring using CNC lathes: - linear interpolation - circular interpolation Describe use of dimensioning practices: - baseline (datum) dimensioning - relative (chain) dimensioning Describe the set-up and programming practices (fixed cycles) of single point threading: - part programming using G76 threading cycle - part programming using G32 threading cycle - cutting multiple lead threads - taper threads
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4.Describe part programming methods, set-up sheets, tooling lists, part program manuscripts, and input media. (4.5 hrs)	4.1 Identify documentation for CNC machining processes: - set-up sheet - tooling list - part program manuscript - input media Describe the individual components of a part program manuscript: - sequence numbers - preparatory functions - axis motions

	- feed rates - spindle speeds - tool numbers - miscellaneous functions Describe additional word and block structures that exist within the part program code: - leading zero suppression - trailing zero suppression - decimal point programming - block delete - comments Describe the individual components of a set-up sheet: - part zero position - part location Describe the individual components of a tooling list: - tool type - tool number - tool offset X & Z Describe the common means of producing part program files: - manual programming - CAM systems - conversational programming
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5.Describe manual operation systems for CNC turning centres. (5 hrs)	5.1 Describe manual interruption: - single block operation - feedhold - emergency stop Describe manual data input (MDI): - line command execution - set-up applications Describe practical applications of the program data override: - rapid motion override - spindle speed override - feedrate override - dry run operation - manual absolute setting Describe interfacing to peripherals: - RS-232C Interface - PC/DNC

Course Outcome 6	Learning Objectives for Course Outcome 6
6.Develop a plan for CNC programming a turning centre. (5 hrs)	6.1 Identify CNC machine to produce job: - machine tool type - CNC system Interpret CNC documentation and data to determine: - workpiece material specifications - methods or routing instructions Plan sequence of machining by identifying: - order of operations - tooling requirements - workpiece set-up
Course Outcome 7	**Learning Objectives for Course Outcome 7**
7.Demonstrate procedures for entering and verifying programs for CNC turning centres to perform linear and circular machining.(19 hrs)	7.1 Demonstrate use of preparatory commands: - modality of G-Codes - conflicting commands - order in a block Demonstrate use of M-codes: - typical M-codes - M-codes in a block Demonstrate use of codes to specify dimensions: - metric/inch selection - absolute data input - incremental data input - combination in the same program - diameter programming - leading and trailing zeros input Demonstrate use of codes to specify word and block structures: - program identification - O-block ISO and EIA identification - block number - N-word - starting number - increments - end of block - carriage return - semi-colon - block description - status block (safe block) - message block (program comments) - conflicting words - modal programming values

- execution priority

Demonstrate use of codes to specify tool function:

- tool offset registration
- lathe application
- tool number
- offset number

Demonstrate use of codes to specify speeds and feeds:

- S-code
- spindle rotation direction
- spindle stop
- spindle speed (rpm)
- feedrate control
- feedrate function
- feedrate per minute
- feedrate per revolution
- feedrate override and feedhold
- feedrate override and functions
- maximum feedrate per revolution

Demonstrate use of codes to specify reference points:

- machine reference point
- manufacturers` setting
- workpiece reference point
- program zero application
- tool reference point
- at the tip
- position register command
- G54 command

Demonstrate use of codes to establish tool compensation:

- general concepts
- difference in tool length
- length from tool tip
- present tool length

Demonstrate use of codes to invoke zero return commands:

- return to machine zero

Demonstrate use of codes for rapid positioning:

- rapid traverse motion
- positioning mode
- G00 command
- tool path
- workpiece approach
- single axis motion
- multi-axis motion
- straight angular motion

	- type of motion - rapid motion formulas - axis motion completion - reduction of rapid motion rate Demonstrate use of codes to create contouring programs: - linear interpolation - G01 command - single axis motion - interpolation in two axes - circulation interpolation - programming format - direction of motion (G02 and G03) - start and end point of an arc - blend radius - feedrate for circular motion - rough and finished shape - methods of calculations - work sketch and calculations - sheet of coordinates Demonstrate entering and verifying programs: - rough turn - finish turn - groove - thread Demonstrate downloading of programs: - feeds - speeds - overrides - axis selection - mode selection Demonstrate manual program execution: - manual data input - handle controls - emergency stop buttons - cancel switches - cycle start - feed hold - single block

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Attendance, Participation and Attitude	5%
Final Test and Practical Project	50%
Mid term	25%

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	Quiz 1	10%
	Quiz 2	10%
Date:	January 3, 2021	
Addendum:	Please refer to the course outline addendum on the Learning Management System for further information.	