<p style="text-align:center">**COURSE SYLLABUS**</p>

LAST REVIEW	Fall 2022
COURSE TITLE	CNC Operations II
COURSE NUMBER	MACH 0203
DIVISION	Career and Technical Education
DEPARTMENT	MACH
CIP CODE	48.0501
CREDIT HOURS	6
CONTACT HOURS/WEEK	Class: 2 Lab: 8 Clinical: 0
PREREQUISITES	MACH 0103, MACH 0105, MACH 0107, MACH 0108, MACH 0109, MACH 0202

COURSE DESCRIPTION
This course will introduce the learner with operations and to properly identify, set-up, and operate Computer Numerical Controlled (CNC) metal turning, milling equipment safely. This course will emphasize hands on approach as well as classroom activities to familiarize the student with the process to complete job task analysis. This course will also cover common mathematical formulas that will be implemented in to the curriculum to achieve expected learner outcomes.

PROGRAM ALIGNMENT
This course is part of a program aligned through the Kansas Board of Regents and Technical Education Authority. For more information, please visit:
https://kansasregents.org/workforce_development/program-alignment

PROGRAM LEARNING OUTCOMES

1. Students will be able to select tools, set up, and operate CNC mills and lathes.
2. Students will be able to program CNC mills and lathes by reading and interpreting technical drawings.
3. Students will be able to create CAD drawings of precision parts based on written descriptions and rough sketches.
4. Students will be able to make adjustments to CNC offsets based on measured dimensions to machine parts within specified print tolerances.

TEXTBOOKS
http://kckccbookstore.com/

METHODS OF INSTRUCTION
A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE
I.   General Applications
    A. Analyze special tooling
    B. Define special holders
    C. Determines correct tool holding methods
    D. Plan tooling lists and selects proper tooling
    E. Plan sequence of operations
    F. Equipment adjustments to maintain accuracy
    G. Properly start-up and shuts down equipment
    H. Edit programs
    I.   Set-up communication links
    J.   Identify control functions
    K. Establish offsets and work shifts
    L.   Establish coordinate systems
    M. Program controls to run equipment
    N. Proper cleanness of shop and related equipment
    O. Equipment safety
    P. Recordkeeping
    Q. Job planning
II. CNC Lathe Operations
    A. Conduct job hazard analysis for CNC lathe
    B. Set-up lathe equipment for operations
    C. Enter tool offsets (G54 ECT.)
    D. Run equipment in MDI mode
    E. Interrupt auto cycle manually to stop cycle run
    F. Execute emergency shutdown procedures
    G. Establish constant SFPM and G50
    H. Turn parts within tolerance ranges
    I.   Record maintenance performed on equipment
    J.   Machine maintenance
    K. Perform PMI on CNC lathes
    L.   identify types and classification for fits.
    M. Calculation of formulas for common mathematic problems used in lathe operations
III. CNC Vertical Milling Machine Operations
    A. Conduct job hazard analysis for CNC mill
    B. Set-up milling equipment for operations

C. Enter tool offsets (G54 ECT.)
D. Run equipment in MDI mode
E. Interrupt auto cycle manually to stop cycle run
F. Execute emergency shutdown procedures
G. Establish constant SFPM and G50
H. Machine parts to proper tolerances
I. Machine maintenance
J. Perform PMI on CNC mills
K. Record maintenance performed on equipment
L. identify types and classification for fits
M. Calculation of formulas for common mathematic problems used in milling operations

COURSE LEARNING OUTCOMES AND COMPETENCIES
Upon successful completion of this course, the student will:

A. Identify CNC lathes and CNC mills
   1. Identify parts of CNC milling machine.
   2. Identify parts of CNC lathes.
   3. Identify accessories for CNC mills.
   4. Identify accessories for CNC lathes.
   5. Part holding devices.

B. Implement safety and working conditions
   6. Conduct a job hazard (JHA) for CNC lathes and CNC mills.
   7. Recite safety rules for CNC lathe and CNC mills.
   8. Perform machine maintenance.
   9. Record maintenance performed on CNC equipment.
   10. Safely operate CNC equipment.
   11. Apply precautions needed to minimize shop hazards with equipment.

C. Correctly identify coordinate system of CNC lathe and CNC mills
   12. Describe Cartesian coordinate system.
   13. Identify machine axis on CNC mills.
   14. Identify machine axis on CNC lathes.

D. Plan work methods for machining parts
   15. Create job analysis for production of parts from blueprints.
   16. Create job procedure list for sequence of operations.
   17. Create job analysis for one off replication of parts.
   18. Maintain log for tooling used.
   19. Set-up work holding fixtures for CNC mills.
   20. Set-up work holding fixtures for CNC lathes.
   21. Record preventative maintenance log.

E. Interpret programming codes
    22. Identify from list G codes and their intent.
    23. Identify from list M codes and their intent.
    24. Describe conversational programming.
    25. Describe conventional programming.
    26. Identify alarm codes and their affirmative action.

F. Select tooling for job planning
    27. Analyze blueprints to select correct tooling and layout.
    28. Set-up and select tooling.
    29. Set-up tool holders.
    30. Identify coolant application methods used.
    31. Select and apply cutting fluids.

G. Set-up equipment for part producing
    32. Identify part holding chucks, collets, and centers.
    33. Power-up equipment.
    34. Engage emergency stopping procedures.
    35. Demonstrate homing machine.
    36. Describe machine home vs. machine work offset.
    37. Identify CNC equipment control knobs, buttons and lockout controls.

H. Identify and use carbide inserts
    38. Identify carbide inserts.
    39. Select carbide inserts for intended applications.
    40. Install carbide inserts.
    41. Identify numbering system used by carbide mfg.

I. Perform machine communications
    42. Prepare equipment to accept communication from PC.
    43. Download program from PC to machines control.

J. Perform operating procedures for CNC lathes
    44. Machine parts to specified size.
    45. Perform machine maintenance.
    46. Take affirm actions to correct cutting conditions.
    47. Interrupt auto cycle manually to stop cycle run.
    48. Demonstrate MDI methods of axis movements.
    49. Demonstrate tool touch off and establish a G 54.
    50. Input tool offsets to create tool library for tool changes.
    51. Demonstrate offsetting tools with work shifts.
    52. Execute loading a program from equipments memory.
    53. Save a program to equipments memory.

54. Delete a program from equipments memory.
55. Verify CNC program prior to execution.
56. Perform single block methods of operation.
57. Edit a CNC program @ control.
58. Input work shift coordinates equipment to maintain accuracy.
59. Identify and adjust equipment for speed and feeds overrides.
60. Perform turning operations to rough or finish a surface.
61. Perform cylindrical Bore operations.
62. Execute drilling, boring, reaming, chamfering, tapping and radii turning operations.
63. Execute ID OD threading operations.
64. Execute ID OD taper cutting operations.
65. Execute contour turning operations.

K. Perform operating procedures for CNC mills
66. Interrupt auto cycle manually to stop cycle run.
67. Describe machine home vs. machine work offset.
68. Demonstrate homing machine.
69. Demonstrate MDI Methods of axis movements.
70. Demonstrate tool touch off and establish a G 54.
71. Input tool offsets to create tool library for tool changes.
72. Demonstrate offsetting tools with work shifts.
73. Execute loading a program from equipments memory.
74. Save a program to equipments memory.
75. Delete a program from equipments memory.
76. Verify CNC program prior to execution.
77. Perform single block methods of operation.
78. Edit a CNC program.
79. Input work shift coordinates equipment to maintain accuracy.
80. Identify and adjust equipment for Speed and Feeds overrides.
81. Perform machine operations to rough or finish a surface.
82. Perform pocket island operations.
83. Execute drilling, boring, reaming, chamfering or radii turning operations.
84. Execute ID OD Taper cutting operations.

L. Correctly use the Machinery's Handbook
85. Locate information in machinery's handbook.
86. Describe tolerances located in machinery's handbook.

M. Perform shop math for CNC operations
87. Identify fits and calculate parts for final machining.
88. Calculate feed and speeds with chip load per tooth.
89. Calculate trigonometric functions.
90. Convert metric to American and back to mm.

91. Calculate depth of cuts.
92. Calculate hole locations for pattering.
93. Calculate RPM, SFPM.

ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES
Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES
Student Handbook
https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf

College Catalog
https://www.kckcc.edu/academics/catalog/index.html

College Policies and Statements
https://www.kckcc.edu/about/policies-statements/index.html

Accessibility and Accommodations
https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html.