



**NATIONAL UNIVERSITY OF ENGINEERING**  
**COLLEGE OF MECHANICAL ENGINEERING**  
**NAVAL ENGINEERING PROGRAM**

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**MC216 – MANUFACTURING PROCESSES**

**I. GENERAL INFORMATION**

<b>CODE</b>	:	MC-216 Manufacturing Processes
<b>SEMESTER</b>	:	3
<b>CREDITS</b>	:	4
<b>HOURS PER WEEK</b>	:	6 (Theory–Laboratory)
<b>PREREQUISITES</b>	:	MC112 Materials Sciences
<b>CONDITION</b>	:	Compulsory
<b>DEPARTMENT</b>	:	Engineering Sciences

**II. COURSE DESCRIPTION**

The course prepares to the students on topics such as: metalworking theory, cutting of metals processes, materials for cutting tools, life of cutting tools, cutting fluids, mechanical lathe, drill press, milling machine, planer, machining with abrasives. Economic considerations in the machining: Mechanical assembly. Automation in manufacturing. Quality control. Application engineering projects of each chapter are developed in the Machine Tools laboratory.

**III. COURSE OUTCOMES**

1. Analyze and interpret the cutting fundamentals of identifying measuring instruments, machine tools and hand tools. On the other hand, students explain and determine the orthogonal and oblique cuts, the life of cutting tools, defining when the machining process is dry cutting and / or cutting fluid.
2. Understands and applies different conventional machine tools performing machining operations and determining the strength and / or power used in the cutting process at the operation point.
3. Interprets and analyzes the machining process with rigid and / or flexible abrasives, and automation of manufacturing executed CNC programs.
4. Understand and determines economic considerations both machining and mechanical assembly considering that the process runs with quality control.

**IV. LEARNING UNITS**

**1. ANALYSIS AND INTERPRETATION OF THE CUTTING FUNDAMENTALS OF METAL / 12 hours**

Substantiation of manufacturing processes / Fundamentals of cutting metals / Orthogonal Cuts / Oblique cuts / Force and power cutting / Cutting Tools / Cutting Fluids / Taylor's ratio / Life of cutting tools.

**2. CONVENTIONAL MACHINE TOOLS / 20 hours**

Types of machine tools / Basics of building machine tools / Types of lathes / Tilt / Turning parameters / The monofilament tool / Operations with lathe / Driller / Types of drilling / Helical / Operations with the drill / The router / Router types / Horizontal-axis milling machine / Milling cutter / Milling parameters / Milling Operations / Jointer / Planer Types / Brushing parameters / Brushing operations.

### 3. ABRASIVES AND CNC MACHINE TOOLS / 12 hours

Machining with abrasives / Abrasive tools / Grinding machines / Grinding wheel / Grinding processing / Analysis of grinding process / Automation in manufacturing / The evolution of automation / Numerical control / Numerical control by computer / CNC programming / Customizable control / Introduction to industrial robots.

### 4. ECONOMIC CONSIDERATIONS / 12 hours

Time components of manufacturing / Transformation process of the cost / Cost components of a product / Hour cost of operating machine / Mechanical assembly / Assembly and disassembly design / Threaded fasteners / Assembly methods / Quality control / Definition of quality product / Capability process / Statistical tolerances / Statistical control of processes.

## V. METHODOLOGY

The course develops theory sessions and machine tools laboratory. In the theory sessions, the instructor presents the definitions, concepts of manufacturing processes with applications both theoretical and actual cases. In the laboratory practice the definitions made in the theory is checked. At the end of the course, students must submit a job or project in groups of 2 or 4 members. In all sessions, the active participation of the student is encouraged.

## VI. LABORATORY AND PRACTICAL EXPERIENCES

Lab 1: In the laboratory, the student recognizes the measuring instruments, machine tools with accessories and hand tools. Also, the student checks the life of cutting tools working in dry cutting and cutting fluid.

Lab 2: In the laboratory, strength and / or power are determined with measuring device of force and / or voltage drop. The behavior of flexible and rigid abrasives are also checked.

Lab 3: In the laboratory, assembly of projects developed is executed considering previous laboratories. The quality is checked visually and using calibrated instruments.

## VII. EVALUATION FORMULA

The Average Grade PF is calculated as follow:

$$PF = ( EP + 2EF + PL ) / 4$$

$$PL = ( PL1 + PL2 + \dots + PLn ) / n$$

EP: Mid-Term Exam

EF: Final Exam

PL: Average of laboratory experiences

## VIII. BIBLIOGRAPHY

### 1. SILVA VASQUEZ, WILSON JOSE

Manufacturing Processes and Engineering  
Editorial Universitaria EDUNI, First Edition, Peru. 2012.

### 2. GROVER, MIKEL P.

Fundamentals of Modern Manufacturing .  
Prentice – Hall, Hispanoamerican, Mexico. 1997.

### 3. DE GARMO, PAUL; BLUCK, J.T. AND KOHSER, R. A.

Materials and Manufacturing Processes  
Reverte Editorial, Barcelona. 1998.

### 4. KALPAKJIAN, S. AND SCHMID, S. R.

Manufacture. Engineering and Technology.  
Prentice-Hall; Pearson, Fifth Edition, Mexico. 2008.