

**King Fahd University of Petroleum & Minerals**  
**MECHANICAL ENGINEERING DEPARTMENT**  
**ME 407: Advanced Manufacturing Laboratory**

**Catalogue Description:** (0-3-1)

Laboratory demonstrations and experiments and hands on experience of: Measurements (Dimensional Metrology), Variability and Distributions, Manufacturing Tolerances and Process Capability Studies, Surface Roughness Analysis, Experimental Data Analysis to Develop Empirical Models-Use of Excel, and other statistical software's, Advanced Experiments in Machining. Machining Forces and Torque Models. Non Traditional manufacturing, CAD/CAM and CNC machining, Polymers processing and Rapid Prototyping. Integrated Manufacturing Project.

**Status in Curriculum (Required or Elective):** Required AME, Elective ME  
(Offered Fall & Spring)

**Prerequisites:** (ME 322 and ME323) or ISE 322.

**Co-requisites:** ME 406

**Prerequisites by Topics:**

- Machining Processes (ME 322)
- 3D modeling in Solid works (ME210)
- Hands on Experience in Machining, Preparation of Routing and Operational Sheets (ME323)

**Textbook:**

Handouts and lecture slides, Mechanical Engineering Department, King Fahd University of Petroleum & Minerals Dhahran Saudi Arabia

**References:**

- **Manufacturing Processes for Engineering Materials**, Kalpakjian, S., 5th edition, Addison-Wesley, 2008.
- **Principals of Modern Manufacturing**, K. P. Groover, 5<sup>th</sup> edition, SI version, John Wiley, New York. 2012.

**Coordinator:** Mohiuddin Ahmed, Lecturer of Mechanical Engineering

**Goals:(general objectives)**

1. Provide students with hands-on experience for various advanced manufacturing processes and on CNC machining.
2. Enable students to handle and accomplish the CAD/CAM and Integrated Manufacturing Project on CNC machines.
3. Use of LVDT instrumentations in metrology and data acquisition in metal cutting process
4. Enable students to apply statistical analysis techniques for better understanding of the effect of various machining parameters.

**Course Outline (Lab Experiments Topic):**

Workshop orientation, safety procedures and exposure of PPE	(1 Lab)
Precession in dimensional metrology	(1 Lab)
Forces, power and Torque in drilling and turning processes	(2 Labs)
Surface analysis and forces in grinding and milling	(2 Labs)
Plastics processing	(1 Lab)
Hands on learning on CNC machine	(1 Lab)
G-code programing	(1 Lab)
CAD/CAM integration – The Process planning	(1 Lab)
CAMWORKS 2.5D and multi axis learning	(2 Labs)
CAD/CAM Integrated Machining Project	(1 Lab)
Powder Metallurgy processing	(1 Lab)
Rapid Prototyping	(1 Lab)

**Design Activities/Projects:**

One CAD/CAM Integrated machining project

**Computer Usage:**

All the assignments and lab reports are done using computer e.g. Tabulation, Computation, Plotting, Empirical modeling and analysis using MS Excel and Word. CAMWORKS learning and CAD/CAM Integrated machining project

**Assessment Tools:**

1. Experimental reports
2. Laboratory Projects
3. Final Exam

**Course Learning Outcomes:**

- I. Follow safe manufacturing shop practices.
- II. Use of various advanced measuring devices such as dynamometers, surface profiler, electronic comparator, height measuring instrument and optical microscope.
- III. Develop an understanding on the effect of process parameters such as cutting forces, tool life and surface finish in various machining processes such as turning, milling, drilling and grinding followed by developing statistical models.
- IV. Set up experiments to determine optimal process parameters to meet desired process and product outputs.
- V. Learn to work in a team to design manufacturing plan (process planning), handle projects and to machine a part on a CNC machine.
- VI. Using Statistical Tools in Data Analysis and Empirical Models development and CAMWORKS for developing G-code programs for CNC machining.
- VII. Documenting the process design and fabrication activities in a technical report.
- VIII. Understand basic quality control and assurance requirements of a manufactured part.

**Course Learning Outcomes mapped to Student Outcomes:**

Student Outcomes	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Course-to-Student outcome mapping	I, II, V	IV, V, VII	III, VII, VI		IV, VIII						
Emphasis*	S	S	M		L						

\* L:: Little/None                      M: Moderate                      S: Strong

**Status of Continuous Improvement review of this Course:**

**Date reviewed:** -----

**Reviewed by:** Materials and Manufacturing Group

**Prepared by:** Mohiuddin Ahmed

**Date prepared:** March 03, 2014