NORMANDALE COMMUNITY COLLEGE
COMMON COURSE OUTLINE
VACT 1292 and NANO 1292, Introduction to Vacuum Technology

I. EFFECTIVE DATE OF OUTLINE

Fall Semester, 2012. To be reviewed by the department annually.

II. CATALOG DESCRIPTION

A. VACT 1292 and NANO 1292
B. Introduction to Vacuum Technology
C. 1 Credit
D. Offered Fall and Spring Semesters
E. Prerequisites: MATH 0700 or concurrent enrollment OR placement into MATH 1100; Eligible for ENGC 1101
F. Vacuum-based systems are a critical enabling technology used in product development and manufacturing to produce many every-day goods such as digital electronic components, energy efficient glass and metallised films used for food packaging. This course introduces the principle concepts associated with vacuum technology and the critical components of a vacuum system. Students work with a model vacuum system to complete activities intended to help them understand basic vacuum system functions and characteristics.

III. RECOMMENDED ENTRY SKILLS/KNOWLEDGE

Students are expected to possess skills in writing (completion of ENGC 1101), intermediate algebra (completion of MATH 0700 or concurrent enrollment), and some high school chemistry knowledge related to molecular structure and properties/behavior of physical states. Students should possess basic skills in the use of the following Microsoft Office applications: Word and Excel. Examples of basic skills in the use of these software applications are accessing and opening the application, entering, formatting and editing information, and saving files. Students should be prepared to use the college online course site to access information about the class including downloads of file-type information, post homework and interact with the instructor and class peers. Students should also have basic knowledge of how to perform searches for information on the Internet.

IV. OUTLINE OF MAJOR CONTENT AREAS

A. Overview of vacuum systems technology and its applications
B. Safety practices in vacuum systems technology
C. Vacuum properties defined
    a. Pressure the physical quantity
    b. Units of measurement
    c. Magnitudes
    d. Kinetic Theory of Gases
    e. Gas flow
    f. Basic calculations
D. Pressure measurement in vacuum systems
    a. Direct gauges
    b. Indirect gauges
E. Pumps in vacuum systems
    a. Roughing
    b. High vacuum
    c. Ultra-high vacuum
F. Valves
G. Vacuum system operation

V. LEARNING OUTCOMES

Upon successful completion of VACT 2293 or NANO 2293, students will have demonstrated ability to:

A. Identify applications in which use of vacuum-based systems represent a critical process technology in a manufacturing process sequence.
B. Anticipate certain hazards related to working with vacuum-based systems technologies and demonstrate the use of basic safety techniques when operating vacuum-based equipment.
C. Define vacuum conditions qualitatively and quantitatively in magnitude and units of measurement.
D. Convert magnitudes from one unit of measurement to another unit of measurement especially for physical quantities of pressure, volume, temperature and flow.
E. Explain the effect of changing pressure conditions on the molecular motion of gas molecules and the corresponding impact on the mean free path of a molecule, explain the significance of mean free path in vacuum-based processes and calculate the mean free path of a gas molecule given certain physical conditions.
F. Differentiate the types of gas flow both by identifying the general characteristics of the physical conditions and by calculating the Knudsen Number.
G. Apply the relationships between throughput, pumping speed, conductance and pressure to calculate one of these physical quantities.
H. Prepare and interpret graphical representations of vacuum processes.
I. Explain the function of a pressure measurement device in a vacuum system design, differentiate between types of pressure measurement gauges used in vacuum systems, and identify the proper gauge type for basic vacuum conditions.
J. Explain the function of the vacuum pump device in a vacuum system design, differentiate between categories of vacuum pumps used in vacuum systems, and identify the proper pump type for given specifications of basic vacuum system applications.
K. Explain the function of the valve component in a vacuum system design and identify critical physical parameters of the valve based on its function within the vacuum systems.
L. Explain and demonstrate the process to properly achieve pressure crossover in a vacuum system.
M. Execute pumpdown sequences, collect appropriate data, graph data and interpret results.
N. Create a basic lab report which conveys information about a lab activity including the purpose and objective, procedure, summary of results, analysis and conclusion.

VI. METHODS USED FOR EVALUATION OF STUDENT LEARNING

Students will be evaluated on the following categories of course work: (1) assignment work involving both written descriptive answers and mathematical based problem solving; (2) lab reports; (3) demonstration of laboratory competence including but not limited to practices in (a) safety, (b) equipment operation, (c) collecting and documenting data, (d) maintaining a lab notebook; and (4) mid-term and final end-of-course exams.

The final grade will be determined by some appropriate weighting of the course assignments, lab work and exam results.

VII. SPECIAL INFORMATION

A. Students will need access to a model vacuum-based system to conduct a variety of lab activities. The vacuum-based system will be available for student use in the classroom.
B. Students will need access to some safety gear. The safety gear will be available for student use in the classroom.