

**DEPARTMENT OF ADVANCED TECHNOLOGIES  
ROBOTICS AND AUTOMATION TECHNOLOGY  
2008/2009 CORE COURSES COMPETENCIES**

Course Name	Course Objectives & Competencies
TY 101 Problems in Technology	<p><b>Students will demonstrate or be able to:</b></p> <ul style="list-style-type: none"> <li>a. Understanding of basic technological concepts and appropriate terminologies;</li> <li>b. Explain the differences between International System and English/American units of measurements;</li> <li>c. Understanding of basic trigonometric functions;</li> <li>d. Understanding of trigonometry applications in 2D and 3D geometric forms</li> <li>e. Understanding of equipment characteristics, sensitivity of instruments, tolerance, and measurement errors.</li> </ul>
IT 107L Computer Applications Lab – Word Processing	<p><b>Students will demonstrate or be able to:</b></p> <ul style="list-style-type: none"> <li>a. format and organize content</li> <li>b. format documents</li> <li>c. collaborate and customize MS Word</li> </ul>
TY 201 Problems in Engineering	<p><b>Students will demonstrate or be able to:</b></p> <ul style="list-style-type: none"> <li>a. Understanding basic functions;</li> <li>b. Explain the differences between linear and non-linear functions;</li> <li>c. Understanding of spherical elements and bodies;</li> <li>d. Understanding problem solving techniques involving various kinds of functions;</li> <li>e. Understanding basics of computer dynamic modeling and simulations.</li> </ul>
IT 127L Computer Applications Lab – Presentations	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. create content</li> <li>b. format content</li> <li>c. collaborate and manage presentation content</li> <li>d. deliver presentations</li> </ul>
IT 117L Computer Applications Lab – Spreadsheets	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. organize and analyze data</li> <li>b. format data and content</li> <li>c. collaborate and manage data and workbooks</li> <li>d. customize Excel</li> </ul>

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TY 209 Robotics Applications	<p><b>Students will demonstrate knowledge and/or ability to:</b></p> <ul style="list-style-type: none"> <li>a. Develop an understanding of terminology associated with robotics.</li> <li>b. Explain the geometries of the various Industrial Robots according to their axes configuration.</li> <li>c. Explain the classification of the robotics systems.</li> <li>d. Understand the theoretical concepts and relate the theories to industrial applications</li> </ul>
TY 174 Engin. & Tech. C&S	<p><b>Students will be able to explain:</b></p> <ul style="list-style-type: none"> <li>a. Fundamental principles and logic behind the computational languages.</li> <li>b. Concept of programming functions.</li> <li>c. Inputs and outputs in programming.</li> <li>d. Operators.</li> <li>e. Functions calls.</li> <li>f. Sequential programming..</li> </ul>
TY 207 CAD/CAM	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Describe the role of CAD/CAM systems in contemporary product realization processes.</li> <li>b. Identify key trends emerging in the disciplines related to CAD/CAM that will have substantial influence over the product realization process.</li> <li>c. Define and describe fundamental computer and networking technologies that are used to deploy CAD/CAM systems.</li> <li>d. Define fundamental geometric modeling and computer graphics techniques that are used in CAD/CAM system.</li> <li>e. Use CAD Software to create clear, concise, and complete drawings.</li> </ul>

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TY 232 Circuit Analysis I	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Recognize some common components and measuring instruments.</li> <li>b. List electrical quantities and their units.</li> <li>c. Use scientific notation (powers of ten) to express quantities.</li> <li>d. Use metric prefixes to express large and small numbers.</li> <li>e. Convert from one system of units to another.</li> <li>f. Discuss the basic structure of atoms.</li> <li>g. Explain the concept of electrical charge.</li> <li>h. Define current, voltage, resistance, and discuss their corresponding characteristics.</li> <li>i. Describe a basic electric circuit and make basic circuit measurements.</li> <li>j. Explain Ohm's law.</li> <li>k. Calculate current, voltage, and resistance in a circuit.</li> <li>l. Define energy and power.</li> <li>m. Calculate power in a circuit.</li> <li>n. Identify series, parallel, and series-parallel circuits.</li> <li>o. Determine the currents, voltages, resistances, and power in series, parallel, and series-parallel circuits.</li> <li>p. Apply Ohm's law, Kirchhoff's voltage law (KVL), and voltage divider rule in series circuits.</li> <li>q. Apply Ohm's law, Kirchhoff's current law (KCL), and current divider rule in parallel circuits.</li> <li>r. Introduction to capacitors and inductors.</li> <li>s. Know and understand use of the various Circuit Analysis Techniques <ul style="list-style-type: none"> <li>a. Node-Voltage (Nodal) Analysis</li> <li>b. Branch-Current Analysis</li> <li>c. Mesh-Current (Mesh) Analysis</li> </ul> </li> <li>t. Understand the concept of the Thevenin and Norton equivalent circuits and be able to construction Thevenin and Norton equivalents for various types of circuits.</li> <li>u. Understand Operational Amplifiers, Capacitance, Inductance, and Mutual Inductance.</li> </ul>
TY 301 Techn. And Engin. Analy.	<p><b>Students will demonstrate :</b></p> <ul style="list-style-type: none"> <li>a. Understanding of system and process modeling;</li> </ul>

	<ul style="list-style-type: none"><li>b. Understanding of technological process design and simulation;</li><li>c. Applications of mathematics in technology;</li><li>d. Understanding of matrix applications in technological problems solving;</li><li>e. Understanding of basics statistics and simulations</li></ul>
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TY 308 Prod. Planning & Control	<p><b>Students will demonstrate:</b></p> <ul style="list-style-type: none"> <li>a. Understanding of manufacturing planning and control (MPC).</li> <li>b. Understanding of Just-in-time (JIT) concept.</li> <li>c. Understanding of Master production scheduling (MPS).</li> <li>d. Understanding of complete treatment of distribution requirements for aggregate planning and inventory management.</li> <li>e. Understanding of materials requirement (MRPI).</li> <li>f. Understanding of Manufacturing Resource Planning (MRPII).</li> <li>g. Understanding of demand management concepts.</li> <li>h. Understanding of forecasting techniques.</li> </ul>
TY 319 Manufacturing Processes	<p><b>Students will be able:</b></p> <ul style="list-style-type: none"> <li>a. To understand the history of industrial processes in the United States.</li> <li>b. To identify the various classifications and fabrication of metals and composites.</li> <li>c. To identify and specify the tests necessary to assure the acceptance of material.</li> <li>d. To acquire an understanding of methods used to modify materials for strength and other characteristics.</li> <li>e. To understand the importance of process planning.</li> <li>f. To understand the role of the Manufacturing Engineer/Technologists and his/her responsibilities.</li> </ul>
TY 320 Computer Integrated. Manufacturing I	<p><b>Students will:</b></p> <ul style="list-style-type: none"> <li>a. Develop an understanding of production and control systems, management technology, cost systems, and evaluation techniques.</li> <li>b. Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.</li> <li>c. Obtain an overview of computer technologies including computers, database and data collection, networks, machine control, etcetera, as they apply to factory management and factory floor operations.</li> <li>d. Describe the integration of manufacturing activities into a complete system</li> <li>e. Acquire sensitivity to human-factors related issues as they affect decision making in the factory environment.</li> </ul>

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Course Name	Course Objectives & Competencies
TY 322 Occupational Safety and Management	<p><b>Students will demonstrate or be able to:</b></p> <ul style="list-style-type: none"> <li>a. Knowledge of occupational health, safety (H&amp;S) and hygiene.</li> <li>b. Explain the issues that brought safety and health to the attention of society.</li> <li>c. Knowledge of OSHA, NIOSH and other institutions that are involved in safety.</li> <li>d. Knowledge of rights and responsibilities of employees and employers.</li> <li>e. Knowledge of worker compensation and different methods practiced in industry.</li> <li>f. Discuss new and emerging issues of occupational H&amp;S and society's views.</li> <li>g. Knowledge of ergonomics and its place in today's work environment.</li> <li>h. Describe the human factors within the workplace and current continuous improvement.</li> <li>i. Promote occupational safety and health issues at workplace and society.</li> <li>j. Knowledge of mechanical, electrical, fire, noise and vibration, radiation (ionizing and non-ionizing), Computer Display Terminal (CTD), bloodborne pathogen hazards.</li> <li>k. Plan a safety and/or emergency preparedness program.</li> <li>l. Perform accident investigation and respond to OSHA for reportable accidents.</li> <li>m. Knowledge of a safety management system.</li> </ul>
TY323 Principles of Technical Management	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Use the principle of systems to manage technical operations in a firm or organization.</li> <li>b. Demonstrate how to optimize systems designed to deliver quality products, goods or services that are values-oriented to customers.</li> <li>c. Use knowledge of psychology as a technical manager.</li> <li>d. Use effective principles of continuous improvement applied to production and service delivery systems.</li> <li>e. Communicate in Standard English orally and in writing using principles of critical thinking.</li> <li>f. Use readings from the humanities, business and management, industrial and organizational psychology, and science and engineering to demonstrate an increased range, depth, and scope as a technical manager of production and service enterprises.</li> <li>g. Engage in a team-oriented project.</li> <li>h. Use techniques and methodologies of quality management, customer service management, safety management, operations and production management, and human resources management to</li> </ul>

	improve production and service enterprise in the course.
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Course Name	Course Objectives & Competencies
TY 331 Electronics I	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Understand basic semiconductor concepts:               <ul style="list-style-type: none"> <li>1. Silicon structure</li> <li>2. Intrinsic semiconductor</li> <li>3. N-type semiconductor</li> <li>4. P-type semiconductor e. P-N junction diodes structure f. NPN bipolar transistor structure</li> <li>5. PNP bipolar transistor structure.</li> </ul> </li> <li>b. Recognize various semiconductor diodes and understand their principles of operation</li> <li>c. Understand the principles of operation Bipolar Junction Transistors (BJTs)</li> <li>d. Understand the principles of operation Field Effect Transistors (FETs)</li> <li>e. Use these devices to design and build practical electronic circuits such as power supplies and amplifiers.</li> </ul>
TY 339 Plant Layout and Material Handling	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Describe the techniques and procedures for developing an efficient facility layout</li> <li>b. Perform mathematical calculations needed to plan an efficient facility</li> <li>c. Discuss some of the material handling principles and equipment</li> <li>d. Analyze sample facility layouts with reference to design and material handling principles</li> </ul>
TY 398 Technical Content Review	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Explain the classification of the robotics systems;</li> <li>b. Use CAD Software to create clear, concise, and complete drawings;</li> <li>c. Describe a basic electric circuit and make basic circuit measurement;</li> <li>a. Use devices to design and build practical electronic circuits such as power supplies and amplifiers;</li> <li>b. Know a safety management system</li> <li>c. Use techniques and methodologies of quality management, customer service management, safety management, operations and production management, and human resources management to improve production and service enterprise;</li> <li>d. Know about “Total Quality” and its management;</li> <li>e. Understand and usage of materials requirement (MRPI), Manufacturing Resource Planning (MRPII), Just-in-time (JIT) concept, Master production scheduling (MPS), demand management</li> </ul>



	<p>concepts, and forecasting techniques;</p> <p>f. Understand and apply the genesis of Project Management and its importance to improving the success of projects;</p> <p>g. Describe the techniques and procedures for developing an efficient facility layout;</p>
TY 438 Project Management	<p><b>Students will be able to:</b></p> <p>a. Understand the genesis of Project Management and its importance to improving the success of projects.</p> <p>b. Describe the project management knowledge area and life cycle.</p> <p>c. Apply project management concepts by working on a group project as team leader or active member.</p> <p>d. Use Microsoft Project and other software to help plan and manage a project.</p> <p>e. Demonstrate competence in giving oral presentations.</p> <p>f. Share his/her own examples of good and bad project management by preparing a journal and lessons learned report for personal reflection.</p> <p>g. Understand tools and techniques of project management such as Work Breakdown Structures, Network Diagrams, critical path analysis, cost estimates, Motivation theory and team building.</p>
TY 466 SCADA and HMI Sys.	<p><b>Students will knowledge of:</b></p> <p>a. Definition and basics of SCADA and HMI systems</p> <p>b. Elements of SCADA and HMI systems,</p> <p>c. Industrial databases</p> <p>d. Condition based maintenance</p> <p>e. Data logging and monitoring,</p> <p>f. Alarms</p>

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TY 450 Industrial Fluid Power	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Design and analyze hydraulic levers</li> <li>b. Design and analyze closed hydraulic systems (reservoirs, accumulators, pick pumps, pipes, cylinder etc.)</li> <li>c. Design and analyze open hydraulic systems</li> <li>d. Understand pressure and flow measurement and equipment. Pick the measurement equipment and implement it in hydraulic circuits.</li> <li>e. Design and analyze basic pneumatics circuits</li> <li>f. Design and analyze fluid logic circuits</li> <li>g. Design and analyze fluid automatic circuits</li> </ul>
TY 461 PLCs	<p><b>Students will demonstrate knowledge of:</b></p> <ul style="list-style-type: none"> <li>a. PLC types and architectures.</li> <li>b. Different input and output hardware.</li> <li>c. Modular and non-modular PLCs.</li> <li>d. Ladder logic programming.</li> <li>e. Treating analog measurements using PLCs.</li> <li>f. Higher level PLC programming languages.</li> <li>g. Basics of PLC networking</li> </ul>
TY 361 Feedback control	<p><b>Students will demonstrate knowledge of:</b></p> <ul style="list-style-type: none"> <li>a. Modeling and simulation.</li> <li>b. Single input and single output control,</li> <li>c. Multiple input and multiple output systems.</li> <li>d. BIBO and asymptotic stability.</li> <li>e. Control of linear systems,</li> <li>f. PID controllers,</li> <li>g. Optimal linear control</li> </ul>
TY 495 Thesis research	<p>Graduating seniors will gain experience and demonstrate competencies in researching and preparing a technical report commensurate with graduate standing</p>

TY 446 CIM Capstone	Individual student computer integrated manufacturing project.
TY 456 Machine Control Systems	<p><b>Students will demonstrate/be able to:</b></p> <ol style="list-style-type: none"> <li>a. Ability to explain terms such as open loop, closed loop, feedback, summing junction, command, error, and disturbance.</li> <li>b. Describe various characteristics to evaluate performance of a Control Systems.</li> <li>c. Ability to draw open and closed loop block diagrams of a given control system</li> <li>d. Describe the principle of operation of proportional, integral and derivative control.</li> <li>e. Describe Tuning a PID system.</li> <li>f. Describe role of measurement devices in control systems.</li> <li>g. Describe various flow measurement devices and principles of operation.</li> <li>h. Describe various level measurement devices and principles of operation.</li> <li>i. Describe various temperature measurement devices and principles of operation.</li> <li>j. Describe calibration procedure. Explain why regular calibration is needed.</li> <li>k. Ability to explain the working principles of various switches and relays.</li> </ol>

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TY 445 Total Quality Management	<p><b>Students will demonstrate ability to:</b></p> <ul style="list-style-type: none"> <li>a. Describe Quality revolution in American industry</li> <li>b. Define quality in manufacturing and services</li> <li>c. Discuss “Total Quality” and its management.</li> <li>d. Identify different philosophies and their authors or contributors.</li> <li>e. Consider the role of the customer and consumer in evolution of the quality movement.</li> <li>f. Define leadership and know its constituent components.</li> <li>g. Describe the Quality Function Deployment.</li> <li>h. Establish the House Quality matrix</li> <li>i. Apply basic statistics, mean median, mode, standard deviation, probability distribution to quality issues.</li> <li>j. Use statistics for process control</li> <li>k. Know about reliability and its numerical values for the systems arranged serial or parallel.</li> <li>l. Discuss the purpose, elements, and application of Six Sigma</li> </ul>
TY 477 Sen. & Comp. Meas. Ind	<p><b>Students will demonstrate knowledge of:</b></p> <ul style="list-style-type: none"> <li>a. Measurement of force</li> <li>b. Measurement of temperature</li> <li>c. Measurement of pressure</li> <li>d. Measurement of velocity</li> <li>e. Measurement of position</li> <li>f. Basics of signal processing</li> </ul>
TY 496 Sem. & Thesis Defense	<p>This course is a continuation of TY 495. Students are required to present and defend their research findings orally using Microsoft PowerPoint or a similar format</p>