Designation as a ‘Required’ or ‘Elective’ course
TYPE OF COURSE: Required for BSIE Major

Course (catalog) description
COURSE DESCRIPTION: IE 464 Virtual Automation. 3 Hours. Fundamentals of Manufacturing and Automation Modeling using CAD/CAM and computer-integrated manufacturing methods; concepts of virtual manufacturing; industrial robots and automated factory models within virtual environments. Prerequisite: IE 201, CS 107 or equivalent.

Prerequisite(s)
PREREQUISITE(S): IE 201, CS 107 or the equivalent. (Prerequisite by topic: 1. Basic knowledge of computer programming. 2. Basic knowledge of engineering economic analysis)

Textbook(s) and/or other required material
Supplementary References:
2. [www.vrml.org](http://www.vrml.org) (Web3D consortium)

Course objectives
COURSE OBJECTIVES: See major topics & contributions of course to meeting the professional component below.

Topics covered
MAJOR TOPICS:

<table>
<thead>
<tr>
<th>MAJOR TOPICS</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>General concepts: principles of computer graphics and transformation, principles of manufacturing and automation modeling using CAD/CAM and computer-integrated manufacturing methods.</td>
<td>9</td>
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<tr>
<td>Virtual modeling: principles of virtual reality and virtual environments, introduction to virtual reality modeling language</td>
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<td>Modeling industrial automation tasks: assembly, telecollaborative design, training, and management, industrial robots</td>
<td>6</td>
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<td>Interface modeling: real-time interface modeling issues which draw a balance between (i) accuracy and details in representative and (ii) amount of abstraction and assumption for improving computational performance.</td>
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<td>Applications of computational geometry: advanced CAD/CAM methods for developing virtual industrial automation modeling such as accurate collision detection and motion modeling methods.</td>
<td>2</td>
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<td>Sensor and tracking systems: Input data noise reduction and filtering methods, performance and accuracy improvement methods.</td>
<td>9</td>
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<tr>
<td>Code of ethics for engineers</td>
<td>1</td>
</tr>
<tr>
<td>Examinations (1.5 hour lab exam plus 1.5 hour final exam)</td>
<td>3</td>
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<td>Total</td>
<td>45</td>
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Class/laboratory schedule, i.e., number of sessions each week and duration of each session

CREDIT HOURS: 3 hours

TYPE OF INSTRUCTION:

<table>
<thead>
<tr>
<th>Type of Instruction</th>
<th>Contact Hours/Week</th>
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<tr>
<td>Lecture/Discussion</td>
<td>2</td>
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<tr>
<td>Laboratory</td>
<td>1</td>
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Contribution of course to meeting the professional component

This course is intended to make students familiar with CAD/CAM and CIM concepts and applying them by building virtual models. These virtual environments provide a cost effective way of teaching students various industrial automation techniques and concepts which would otherwise be difficult because of lack of resources on conveniences to expose students to actual automated factories. Building virtual models of automated industries can provide alternative learning techniques for various industrial automation concepts, which have so far been difficult because computers were not as powerful and inexpensive as they are today.

Relationship of course to program outcomes

As shown in the BSIE Course Outcomes Matrix:

A. Ability to apply knowledge of mathematics, science and engineering
C. Ability to design a system, component, or process to meet desired needs
I. Life-long learning
J. Knowledge of contemporary issues
K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Person(s) who prepared this description and date of preparation

Pat Banerjee, Professor of Industrial Engineering, January 29, 2002
Pat Banerjee, Professor of Industrial Engineering October 15, 2006

Comments on outcomes

A. Use of vectors, transformations, quaternions, linear algebra; principles of virtual factory; analytical formulations.

C. Several homeworks and two computer projects require the design of simple virtual factories using concepts from virtual reality. Evaluation criteria for designs are also discussed.

I. Dissemination of latest industrial trends and awareness of how to gather information from world-wide-web and other sources such as handbooks.

J. Computer demonstrations on advanced topics in virtual manufacturing to the class.

K. Extensive use of computer programs and techniques such as Virtual Reality Modeling Language from the web. Computer lab assignments based on these.

These outcomes are what students are expected to gain from this course.