Within the next decade, nanotechnology will emerge as the next industrial revolution. Therefore, the next generation of engineers and technologists must be prepared to address issues related to nanotechnology.

- Social
- Ethical
- Regulatory
- Environmental
- Health
- Safety

The proposed effort will address these needs by developing courses that consist of new teaching modules addressing critical issues related to nanotechnology.

A Nanotechnology Advisory Committee consisting of leading scientists and industry professionals in nanotechnology will assist in ensuring the quality and relevance of course content. The research team is highly interdisciplinary with extensive experience in:

- Nanotechnology ethics and safety
- Environmental biology
- Mechanical Engineering
- Manufacturing Engineering
- Electrical Engineering
- Civil Engineering
- Industrial Engineering
- Physics
- Environmental Biology
- Philosophy

Course 1: Introduction to Nanotechnology Safety

<table>
<thead>
<tr>
<th>Module</th>
<th>Theme of the Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>What is Nanotechnology?</td>
</tr>
<tr>
<td>1B</td>
<td>Health, Safety, and Environmental Sustainability</td>
</tr>
<tr>
<td>1C</td>
<td>What are the Nanomaterials?</td>
</tr>
<tr>
<td>1D</td>
<td>How are they used?</td>
</tr>
<tr>
<td>1E</td>
<td>Risk assessment, engineering controls, and professionalism</td>
</tr>
</tbody>
</table>

Course 2: Risk Management of Nanomaterials

<table>
<thead>
<tr>
<th>Module</th>
<th>Theme of the Module</th>
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</thead>
<tbody>
<tr>
<td>2A</td>
<td>Overview of Occupational Health &amp; Safety</td>
</tr>
<tr>
<td>2B</td>
<td>Applications of Nanotechnology</td>
</tr>
<tr>
<td>2C</td>
<td>Assessing Nanotechnology Health Risks</td>
</tr>
<tr>
<td>2D</td>
<td>Sustainable Nanotechnology Development</td>
</tr>
<tr>
<td>2E</td>
<td>Environmental Risks Assessment</td>
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<tr>
<td>2F</td>
<td>Ethical and Legal Aspects of Nanotechnology</td>
</tr>
<tr>
<td>2G</td>
<td>Developing a Risk Management Program</td>
</tr>
<tr>
<td>2H</td>
<td>Presentations of Papers or Case Studies</td>
</tr>
<tr>
<td>2I</td>
<td>Hands-on Training on Using Safety Gear in Nanomanufacturing</td>
</tr>
</tbody>
</table>

Incorporation of Nanotechnology Safety Courses in Curriculum or Modules Into Existing Courses

- UT Tyler
- BS (Industrial Technology) Focus: Nano Management
- TECH 4305 Introduction to Nanotechnology Safety (FULL COURSE)
- BS (Industrial Technology) Focus: Nano Management
- TECH 4305 Introduction to Nanotechnology Safety (FULL COURSE)
- Texas State
- BME/BS (BSE), BSE (BT, ET), BSE (BT, ES)
- US 1100 Seminar
- 2A
- Texas State
- Engineering Nanoscale Materials
- ENGR 2300: Materials Engineering
- 1A, 3A
- Texas State
- BME/BS (BSE)
- ENGR 2332: Materials Selection and Manufacturing Processes
- 6A, 9A
- Texas State
- BME/BS (BSE), BSE (BT, ET), BSE (BT, ES)
- MFG/CE/4324: Microelectronics Manufacturing
- 38, 48
- Texas State
- BME/BS (BSE), BSE (BT, ET), BSE (BT, ES)
- MFG/CE/4334: Microelectronics Manufacturing
- 5A, 9A
- Texas State
- BME/BS (BSE), BSE (BT, ET), BSE (BT, ES)
- MFG/CE 4353: Process Engineering
- 2A, 3A
- Texas State
- BME/BS (BSE), BSE (BT, ET), BSE (BT, ES)
- MFG/CE 4361: Polymer Properties and Processing
- 3A, 4A, 8A
- Texas State
- BME/BS (BSE)
- MFG/CE 4390: Polymer Nanocomposites
- 2B, 4B, 5B, 5B, 6B, 9B

Expected Impact on Undergraduate Minorities

Total enrollment in Engineering and Engineering Technology programs at Texas State 1,100+ students, more than 35% are minorities (10% women, 23% Hispanic, 5% African-American). The majority of students in those programs will be impacted, either by taking required courses that include new modules developed on this project or by taking the semester-long courses.

Multidisciplinary and Ethically Diverse NSF-NUE Team of Investigators

- Dr. Jitendra S. Tate, Principal Investigator, Ingram School of Engineering, Texas State
- Dr. Dominick E. Fazura, Director of Research Development and Technologies, University of Texas at Tyler
- Dr. Craig Hanks, Department of Philosophy, Texas State
- Mr. Satyajit Dutta, Ingram School of Engineering, Texas State
- Dr. Walt Trybula, Ingram School of Engineering, Texas State
- Dr. Robert Manriquez, Department of Biology, Texas State
- Dr. Fritz Althoff, Department of Philosophy, Western Michigan University
- Dr. Christian Wissel, Department of Engineering, California State University, East Bay
- Graduate Researcher: Mr. Lucas Andrade Alves, Mr. Dinesh Kumar Vasudevan, and Ms. Maleki Shadi Shati Texas State; Mr. Adam Mokhtari, UT Tyler
- Undergraduate Researcher: Mr. Sajidip Erez, Ms. Luna Wilson, Mr. Davontae Habbit, Mr. Roger Hernandez, Mr. Daniel Slaughter, Texas State

Government Agencies Involved in Nanotechnology

- OSHA

Contact: Dr. Jitendra S. Tate, Principle Investigator

http://nsf-nue-nanotra.texasstate.edu

http://nsf-nue-engineering.texasstate.edu