ARIZONA STATE UNIVERSITY

# PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE DEGREE PROGRAM

This template is to be used only by programs that have received specific written approval from the Provost's office to proceed with internal proposal development and review. The proposal template should be completed in full and submitted to the University Provost's Office [mailto: curriculumplanning@asu.edu ]. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program may not be implemented until the Provost's Office notifies the academic unit that the program may be offered.

**College/School/Institute:** College of Technology and Innovation

**Department/Division/School:** Engineering

**Proposing Faculty Group** (if applicable)**:** N/A

**Is this is an official joint degree program?** No

If "Yes" List all the additional college(s)/school(s)/institute(s) that will be involved in offering the degree program and providing the necessary resources. Note: All units offering this program must have collaborated in the proposal development and completed the appropriate unit and college/school approvals.

Degree type: BS – Bachelor of Science

If other; provide degree type title and proposed abbreviation:

**Name of degree program** (major)**:** **Manufacturing Engineering**

Are any concentrations to be established under this degree program? No, Concentrations will not be established.

*A separate "Proposal to Establish an Undergraduate Concentration" is required for each concentration.*

**Is a program fee required?** It is expected that this program will fall under the differential tuition proposal for all CTI programs that has been submitted, with a requested effective date of Fall 2013.

**Requested effective catalog year?** **2013-14**

For deadline dates see: Curriculum Workflow Calendars.

**Delivery method:** **On campus only (ground courses and/or iCourses)**

Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the Provost and Philip Regier (*Executive Vice Provost and Dean*) is required to offer programs through ASU Online.

**Campus/Locations:**

Indicate **all** locations where this program will be offered.

☐ Downtown Phoenix ☒ Polytechnic ☐ Tempe ☐ West Other:

**Proposal Contact**

| | | | |
|---|---|---|---|
| Name: | Ann McKenna | Title: | Chair and Associate Professor |
| Phone number: | 480-727-5121 | Email: | ann.mckenna@asu.edu |

**Dean Approval(s)**

This proposal has been approved by all necessary unit and College/School levels of review. I recommend implementation of the proposed program.

**College/School/Division Dean name:** Dean Mitzi Montoya, see attached email for approval

**Signature** _____ **Date:** / /20

**College/School/Division Dean name** (if more than one college involved)**:**

**Signature** _____ **Date:** / /20

*An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.*

ARIZONA STATE UNIVERSITY

# PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE DEGREE PROGRAM

1. Purpose and Nature of Program

Provide a brief program description. Include the distinctive features of the program that make it unique.

Manufacturing is often the culmination of the engineering process. Successful manufacturing enterprises balance design, sustainability and quality with production to sustain competitive advantage in the global marketplace. Manufacturing engineering draws upon two distinct bodies of knowledge, manufacturing processes (e.g., how materials are altered in either shape or properties) and the processes of manufacturing (e.g., manufacturing systems and management). These foundations cut across most manufacturing industries. Thus, this combination of topics is embedded in the proposed BS in Manufacturing Engineering program. There are no other manufacturing engineering programs within the state of Arizona.

This program being proposed is an evolution of the existing, and long standing, BS in Manufacturing Engineering Technology degree within the College of Technology and Innovation (CTI). This successful program, the only BS degree with manufacturing in its title in the state, provides the CTI with a strong foundation for the new program with its outstanding laboratories, faculty and alumni base in many of the manufacturing operations within the metropolitan area and region. (After the new BS in Manufacturing Engineering program is established, the engineering technology program, now renamed, will have its ABET accreditation go through a sunset process over the next four to five years.)

The new program will produce graduates who are prepared for employment in a variety of types of manufacturing environments, e.g., high volume/low value mix environments as well as the high value/low volume environments often found in aerospace. The applied nature of manufacturing is well aligned to the mission of the College of Technology and Innovation and to the needs of local industry. The proposed BS program utilizes lower division coursework from the CTI BSE in Engineering program and also contains a strong emphasis on practical work through a project spine. This engineering experience spine, with its project class each semester, culminates with a two-semester college-wide capstone experience involving multi-disciplinary teams of students. These experiences are supplemented with more detailed modeling, simulation, and manufacturing processes content in individual courses. Students will gain proficiency in manufacturing processes through the use of the department's state-of-the-art facilities and will also graduate with the ability to model, simulate, and analyze manufacturing production processes for both small and large scale environments. This combination of skill-sets will prepare graduates to both understand how to manufacture a small number of items and how to scale this production up efficiently across a global supply chain. The combination of faculty expertise, well-equipped facilities with professional staff, the project-centered focus of the curriculum, and our embedded engagement with industry will make this a strong program that can aid both Arizona and the nation in their quest for high levels of manufacturing competiveness.

2. Student Learning Outcomes and Assessment Methods

A. Knowledge, competencies, and skills

**List the knowledge, competencies, and skills students should have when they graduate from the proposed degree program.(You can find examples of program Learning Outcomes at (http://www.asu.edu/oue/assessment.html)** Upon graduation, students will have a range of design, analytical, process, operational and communication skills that are the common basis of engineering. In addition, they will be able to apply these skills within the context of the manufacturing environment to develop and improve products through application of tools, techniques, data and materials.

Specific program outcomes include the following:

**A. Professionalism**–An understanding of professional and ethical responsibility, a commitment to on-going professional competence and possession of basic professional and organizational success skills.

**B. Communication**–An ability to communicate effectively; selects and adapts communication strategies to fully engage their audience.

**C. Engineering Practice**–An ability to use the knowledge, techniques, skills, and modern tools necessary for engineering practice; effectively adapts planning, team work, and tool use to achieve sound professional practice and defensible solutions to problems.

**D. Critical Thinking and Decision Making**–An ability to think critically, clearly identifying and using evidence, criteria, and values in the decision-making process.

**E. Design**–An ability to design a system, component, or process to meet desired needs within realistic constraints

**F. Perspective**–An understanding of the role and impact of engineering in contemporary business, global, economic, environmental, and societal contexts.

**G. Technical Competence**–An ability to apply knowledge of mathematics, science, and engineering as well as collect, analyze, and interpret data. In particular, the EAC of ABET specifies graduates in a manufacturing engineering program must have proficiency in:

- Materials and manufacturing processes
- Ability to design processes that generate products that meet specs
- Process, assembly, and product engineering
- Ability to design products as well as equipment, tooling, and environment necessary for their manufacture
- Manufacturing competitiveness
- Ability to create competitive advantage through planning, strategy, quality, and control
- Manufacturing system design
- Ability to analyze, synthesize, and control mfg operations using statistical methods
- Manufacturing lab/facility experience
- Ability to measure manufacturing process variables and develop associated technical inferences

## B. Assessment

**Describe the plan and methods to assess whether students have achieved the knowledge, competencies and skills identified in the Learning Outcomes. (You can find examples of assessment methods at (http://www.asu.edu/oue/assessment.html)**

The assessment plan has the dual purpose of determining student achievement of educational objectives and student outcomes, as well as evolution and improvement of the BS in Manufacturing Engineering program. Program assessment is accomplished by periodically collecting information from various sources, which is evaluated by program faculty and administration to determine appropriate program and curriculum changes. Assessment information includes: student and faculty course assessment, graduating student survey, direct measures of student outcome achievement in relation to completion of key project courses, alumni survey, alumni employer survey, and industry board input.

Information from these sources is evaluated to determine student achievement of student outcomes and program objectives, and it is evaluated in conjunction with information received from the program's industry advisory board to refine and evolve the program. Program faculty and administration are responsible for conducting regular evaluations, as well as initiating and documenting appropriate curricular action based upon the evaluations. Each required course in the program identifies course level outcomes that are tied to program level student outcomes. The course outcomes and their mapping to program student outcomes validate each course's place in the program.

Student performance based outcome assessment is aimed at identifying student strengths and weaknesses relative to each student outcome in addition to determining whether the collective student body is adequately achieving outcomes. The assessments are used to continuously improve the program. The culminating (senior year) project is industry-driven and project teams have industry as well as faculty mentors. Faculty committees utilize mentor input in conjunction with project artifacts to assess student strengths and weaknesses relative to program outcomes. Examples of outcomes and corresponding assessment methods are provided in Table 1. This is not an exhaustive list but is included to illustrate our approach.

Table 1. Examples of program outcomes and assessment methods.

| OBJECTIVE | OUTCOME | COURSES SUPPORTING OUTCOMES | ASSESSMENT METHOD |
|---|---|---|---|
| Design | An ability to design a system, component, or process to meet desired needs within realistic constraints | All project courses—8 total | Project reports, student portfolios, final presentations, designed artifact, survey feedback from external partners |
| Technical Competence | Ability to analyze, synthesize, and control mfg operations using statistical methods | EGR 382, EGR 480, EGR 483 | Competency assignments, exams, project reports |
| Engineering Practice | An ability to use the knowledge, techniques, skills, and modern tools necessary for engineering practice; effectively adapts planning, team work, and tool | EGR 401, 402, 485 | Feedback from industry sponsor, team evaluations, designed artifacts |

| | | | |
|---|---|---|---|
| | use to achieve sound professional practice and defensible solutions to problems. | | |

3. Academic Curriculum and Requirements

A. Major Map.
Attach a copy of the "proposed" major map for this degree program and each concentration(s) to be offered. Instructions on how to create a "proposed major map" in BAMM can be found in the Build a Major Map Training Guide.

B. Summary of credit hours required for this program
Total credit hours must be 120 and include first year composition, general studies, core/required courses, program specific electives, and any additional requirements (e.g., concentration credits).

| **Requirements** | **Credit Hours** |
|---|---|
| First Year Composition | 6 |
| ASU 101 (or Equivalent) *CTI 101* | 1 |
| General Studies *Remaining general studies satisfied concurrently with program requirements.* | 12 |
| Core/required courses: *includes 20 units which concurrently satisfy general studies* | 89 |
| Program specific electives | 6 |
| Additional requirements: *Capstone Courses; includes 3 units which concurrently satisfy General Studies* | 6 |
| Other: please explain | |
| **Total** | **120** |

C. Core/Required Courses.

i. Total required and/or core course credit hours: 114

ii. List the name, prefix, and credit hours for each required/core course for this program

| PREFIX | NAME/TITLE | CREDITS |
|---|---|---|
| CHM 113 | General Chemistry I (SQ) | 4 |
| EGR 101 | Introduction to Engineering Design I | 3 |
| EGR 102 | Introduction to Engineering Design II | 3 |
| EGR 104 | Critical Inquiry in Engineering (L) | 3 |
| EGR 201 | Fall Multidisciplinary Project | 3 |
| EGR 202 | Spring Multidisciplinary Project | 3 |
| EGR 216 | Fundamentals of Engineering Systems I | 3 |
| EGR 217 | Fundamentals of Eng Systems II | 3 |
| EGR 218 | Materials and Manufacturing Processes | 3 |
| EGR 219 | Computational Modeling of Engineering Systems | 3 |
| EGR 280 | Engineering Statistics (CS) | 3 |
| EGR 301 | Fall Concentration Project | 3 |
| EGR 302 | Spring Concentration Project | 3 |
| EGR 381 | Manufacturing Processes and Validation lab | 3 |
| EGR 382 | Modeling of Manufacturing Systems I | 3 |
| EGR 383 | Communications in a Production Environment | 3 |
| EGR 385 | Design for Manufacturing | 3 |
| EGR 387 | Industrial Automation | 3 |
| EGR 480 | Advanced Statistical Approaches for Manufacturing | 3 |
| EGR 481 | Manufacturing Econometrics | 3 |
| EGR 482 | Materials Science in Manufacturing | 4 |

| | | |
|---|---|---|
| EGR 483 | Manufacturing Systems Operations | 3 |
| EGR 485 | Engineering Internship | 2 |
| HST 318 | History of Engineering ((L or SB) & G) | 3 |
| MAT 265 | Calculus for Engineers I (MA) | 3 |
| MAT 266 | Calculus for Engineers II (MA) | 3 |
| MAT 267 | Calculus for Engineers III (MA) | 3 |
| MAT 275 | Modern Differential Equations (MA) | 3 |
| PHY 121 | University Physics I: Mechanics (SQ) | 3 |
| PHY 122 | University Physics Laboratory I (SQ) | 1 |

D. Program Specific Electives.

i. Total required program elective credit hours: 6

ii. List the name, prefix, and credit hours for any program specific electives for this program:

Students select two courses from the following list.

| PREFIX | COURSE TITLE | CREDITS |
|---|---|---|
| EGR 386 | Integrated Circuit Manufacturing | 3 |
| EGR 486 | CNC Computer Programming | 3 |
| EGR 487 | Casting and Forming Processes | 3 |
| EGR 488 | Plasma Processing | 3 |

E. Additional Program Requirements (if any):

List and describe any capstone experiences, milestone, and/or additional requirements.

The capstone sequence is a comprehensive project experience based on cumulative knowledge and skills gained in earlier course work.

| | | |
|---|---|---|
| EGR 401 | Engineering Capstone Project I (L) | 3 |
| EGR 402 | Engineering Capstone Project II | 3 |

F. Concentrations

Are any concentrations to be established under this degree program? **No**

i. List courses & additional requirements for the proposed concentration (s):

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**4. New Course Development**

A. Will a new course prefix (es) be required for this degree program? No

If yes, list prefix name(s) (i.e. ENG- English)

Note: A request for a "New/Change to Prefix Request Form" must be completed for each new prefix required and submitted with this proposal: http://provost.asu.edu/files/shared/curriculum/Prefix_Request.doc.

B. New Courses Required for Proposed Degree Program.

List all new courses required for this program, including course prefix, number and course description.

All required courses exist within the Engineering Department course bank, under the EGR prefix. In the future, as the program grows, a new prefix of MFG will be requested and appropriate courses will be modified/created under that prefix.

**5. Program Need**

Explain why the university needs to offer this program (include target audience and market).

This program is an evolution of the existing, and successful, BS in Manufacturing Engineering Technology degree within the College of Technology and Innovation (CTI). Thus, the CTI believes there is a documented need for a manufacturing-focused engineering program at the baccalaureate level. There is no other manufacturing engineering program in Arizona, so this new degree fills a gap while also complementing the existing programs at ASU. In spite of the popular misconceptions about manufacturing and employment opportunities, the Manufacturing Engineering Technology graduates have been highly sought after by industry, both locally and regionally. Thus, graduates of the new

manufacturing engineering program are expected to be vigorously recruited by industry.

Arizona, and in particular the Phoenix metropolitan area, has a high concentration of high-technology manufacturing in such areas as aerospace and semiconductors. Such industries are vital to the economy of the state, but are also continuously being wooed by ambitious alternative locations. A productive relationship with a local university is one of the recognized location advantages. The new program will provide a wider and deeper interaction with local companies and also hopefully serve as a magnet for further investment in Arizona.

There are 21 accredited Manufacturing Engineering degree programs in the country (none in Arizona). Their most significant common feature is the stress they lay on productive local industry interactions. This proposal is equally distinctive in that it looks forward to the industry of the next decade, having the target core competencies built around advanced technology in both factory management and the products produced.

Using the existing MET program as a benchmark, we anticipate an enrollment of 40-60 students after a year or two of existence. Once fully launched and at steady state, we expect that the BS Manufacturing Engineering students would comprise up to 1/5 of the total undergraduate engineering student enrollment at Poly.

## 6. Impact on Other Programs

List other academic units that might be impacted by the proposed program and describe the potential impact (e.g., how the implementation of this program might affect student headcount/enrollment, student recruitment, faculty participation, course content, etc. in other programs). Attach letters of collaboration/support from impacted programs.

The Fulton School of Engineering was asked for comment and their response is included in the supporting documents submitted with the proposal. No impact is expected on existing Engineering Programs.

## 7. Projected Enrollment

How many new students do you anticipate enrolling in this program each year for the next five years?

The projected enrollment reflects those students expected to change majors from existing manufacturing related programs within CTI.

| 5-YEAR PROJECTED ANNUAL ENROLLMENT | | | | | |
|---|---|---|---|---|---|
| | 1st Year | 2nd Year (Yr 1 continuing + new entering) | 3rd Year (Yr 1 & 2 continuing + new entering) | 4th Year (Yrs 1, 2, 3 continuing + new entering) | 5th Year (Yrs 1, 2, 3, 4 continuing + new entering) |
| Number of Students Majoring (Headcount) | 10 | 40 | 60 | 80 | 100 |

## 8. Accreditation or Licensing Requirements

If applicable, provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

The proposed BS in Manufacturing Engineering will be accredited by the EAC of ABET. It is expected to be visited at the same time as the CTI BSE in Engineering in 2015. This program also will have to satisfy the manufacturing engineering program criteria.

## 9. Faculty & Staff

### A. Current faculty

List the name, rank, highest degree, area of specialization/expertise and estimate of the level of involvement of all current faculties who will teach in the program.

| NAME | RANK | DEGREE | SPECIALIZATION | INVOLVEMENT 1-Teach; 2=Teach+Advise 3=Teach, Advise, Admin |
|---|---|---|---|---|
| Ann McKenna | Assoc. Prof. & Chair | PhD | Design/Mechanical Engineering | 3 |
| Scott Danielson | Assoc Prof | Ph.D. | Mechanical/Manufacturing Engineering | 3 |

| | | | | |
|---|---|---|---|---|
| Angela Sodemann | Asst. Prof. | Ph.D. | Manufacturing Engineering | 2 |
| Darryl Morrell | Assoc Prof | Ph.D. | Electrical Engineering | 3 |
| Chell Roberts | Professor | Ph.D. | Industrial Engineering | 3 |
| Jennifer Bekki | Asst. Prof. | Ph.D. | Industrial Engineering | 2 |
| Jerry Gintz | Senior Lecturer | M.S. | Manufacturing Engineering | 2 |
| Trian Georgeou | Senior Lecturer | M.S. | Manufacturing Engineering | 2 |
| Sharon Lewis | Senior Lecturer | Ph.D. | Manufacturing Engineering | 2 |
| Changho Nam | Assoc Prof | Ph.D. | Aerospace Engineering | 2 |
| John Rajadas | Assoc Prof | Ph.D. | Aerospace Engineering | 2 |
| Bradley Rogers | Assoc Prof | Ph.D. | Mechanical Engineering | 2 |
| Thomas Sugar | Assoc Prof | Ph.D. | Mechanical Engineering | 2 |
| Sangram Redkar | Asst. Prof. | Ph.D. | Mechanical Engineering | 2 |
| James Contes | Senior Lecturer | M.S. | Automotive | 1 |
| Scott Pollat | Lecturer | M.S. | Energy Systems | 1 |
| Abdel Mayyas | Asst. Prof. | Ph.D | Automotive Engineering | 2 |
| Shawn Jordan | Asst. Prof. | PhD | Electrical Engineering | 2 |
| John Robertson | Professor | Ph.D. | Electrical Engineering | 3 |

B. **New Faculty:**

Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

None

C. **Administration of the program.**

Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

The program will be administered by the Department of Engineering at the Polytechnic campus. The Chair, Dr. Ann McKenna, will provide administrative oversight. Advising will be provided by the College of Technology and Innovation using the same model currently in use for all other programs in the college. Admission, registration, course scheduling, and graduation (audit) support will be provided as is currently provided for the other programs in the Department of Engineering – through a combination of support at the departmental, college and university levels.

**10. Resources (necessary to launch and sustain the program)**

A. **Required resources:**

Describe any new resources required for this program's success, such as new support staff, new facilities, new library resources, new technology resources, etc.

Existing resources to initiate the program exist within the Department of Engineering. The department has two main fabrication facilities that will be used to support the program. One such facility currently supports the existing Manufacturing Engineering Technology program, and these resources will support the proposed BS in Manufacturing Engineering program as the Manufacturing Engineering Technology is transitioned. Additional existing resources include those associated with the BSE in Engineering, e.g., instructional studios and laboratories as well as departmental administrative staff support, including multiple manufacturing related laboratory staff, computing facilities, and existing collaborative workspaces within the college.

B. **Resource acquisition:**

Explain how the resources to support this program will be obtained.

Existing resources will be used to start the program, and as the program grows, further resources will be acquired based on student need. Expenditures for new resources will be come from a combination of BS Manufacturing Engineering student fees, e.g., the expected differential tuition for CTI programs.

ARIZONA STATE UNIVERSITY

**PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE DEGREE**

## APPENDIX
## OPERATIONAL INFORMATION FOR UNDERGRADUATE PROGRAMS

(This information is used to populate the Degree Search/catalog website.)

1. **Program Name (Major):** BS Manufacturing Engineering

2. **Program Description** (150 words maximum)

Manufacturing is in a period of dramatic transformation. Future manufacturing will involve a global supply network to enable innovation, design, and integration of products and services. Manufacturing engineers work in an ever changing, fast paced, and complex environment. They are key team members in the production of products such as automobiles, airplanes, electronic devices, surgical instruments, toys, building products, and foodstuffs. Manufacturing engineers design the processes to make products with the required functionality, to desired quality standards, based on customer needs, at the best possible price, and in environmentally-friendly ways. The manufacturing curriculum is project-based and provides students a hands-on, team-based learning environment. The manufacturing program has outstanding fabrication facilities that are a hallmark of the program.

3. **Contact and Support Information**

| | |
|---|---|
| Building Name, code and room number: *(Search ASU map)* | TECH 101 |
| Program office telephone number: (*i.e. 480/965-2100*) | 480/727-1874 |
| Program Email Address: | egr@asu.edu |
| Program Website Address: | https://technology.asu.edu/index.php?q=engineering/ |

4. **Delivery/Campus Information Delivery:** On campus ground– i-courses

*Note: Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online.*

5. **Campus/Locations:** *indicate **all** locations where this program will be offered.*

☐ Downtown Phoenix ☒ Polytechnic ☐ Tempe ☐ West Other:

6. **Additional Program Description Information**

A. Additional program fee required for this program? Yes (expected to be CTI differential tuition)

B. Does this program have a second language requirement? No

7. **Career Opportunities & Concentrations**

Provide a brief description of career opportunities available for this degree program. If program will have concentrations, provide a brief description for each concentration. (150 words maximum)

Graduates typically work as manufacturing engineers in a variety of companies, large and small. They are often members of design and development teams, cooperating with other people in and outside of their company. Career employment opportunities include direct manufacturing support, manufacturing management and quality control and assurance in large and midsized, established manufacturing companies. Due to a strong, broad and practical engineering skill set, graduates are also highly valuable in small companies or new start-up companies. Our graduates are well placed and command top salaries in their engineering careers.

8. **Additional Admission Requirements**

If applicable list any admission requirements (freshman and/or transfer) that are higher than and/or in addition to the university minimum undergraduate admission requirements.)

None

**9. Keywords**

List all keywords used to search for this program. Keywords should be specific to the proposed program.

Manufacturing Engineering, Engineering, Production, Manufacturing Systems, ABET, Robotics, Automation, Manufacturing, Design, Innovation, CNC, Machining, Manufacturing Processes,

**10. Advising Committee Code**

List the existing advising committee code to be associated with this degree. UGTEIN

*Note: If a new advising committee needs to be created, please complete the following form:*
*Proposal to create an undergraduate advising committee*

**11. First Required Math Course**

List the first math course required in the major map. MAT 265 Calculus for Engineers I

**12. Western Undergraduate Exchange (WUE) Eligible:**

Has a request been submitted to the Provost by the Dean to consider this degree program as eligible for WUE? YES

*Note: No action will be taken during the implementation process with regards to WUE until approval is received from the Provost.*

**13. Area(s) of Interest**

A. Select **one (1)** primary Area of Interest from the list below that applies to this program.

- ☐ Architecture, Construction & Design
- ☐ Artistic Expression & Performance
- ☐ Biological Sciences, Health & Wellness
- ☐ Business, Management & Economics
- ☐ Communication & Media
- ☐ Computing & Mathematics
- ☐ Education & Teaching
- ☒ Engineering & Technology
- ☐ Environmental Issues & Physical Science
- ☐ Interdisciplinary Studies
- ☐ Languages & Cultures
- ☐ Law & Justice
- ☐ Social Science, Policies & Issues

B. Select **any** additional Areas of Interest that apply to this program from the list below.

- ☐ Architecture, Construction & Design
- ☐ Artistic Expression & Performance
- ☐ Biological Sciences, Health & Wellness
- ☒ Business, Management & Economics
- ☐ Communication & Media
- ☒ Computing & Mathematics
- ☐ Education & Teaching
- ☐ Engineering & Technology
- ☐ Environmental Issues & Physical Science
- ☐ Interdisciplinary Studies
- ☐ Languages & Cultures
- ☐ Law & Justice
- ☐ Social Science, Policies & Issues

**The following fields are to be completed by the Office of the Executive Vice President and Provost of the University.**

**CIP Code:** _____

**Plan Code:**

ARIZONA STATE UNIVERSITY

**2013 - 2014 Major Map**
**Manufacturing Engineering , BS (Proposed)**

| **Term 1** 0 - 14 Credit Hours **Critical course signified by** ◆ | **Hours** | **Minimum Grade** | **Notes** |
|---|---|---|---|
| ◆ CHM 113: General Chemistry I (SQ) | 4 | | • An SAT, ACT, Accuplacer, or TOEFL score determines placement into first-year composition courses<br>• ASU Math Placement Exam score determines placement in Mathematics course<br>• ASU 101 or College specific equivalent First Year Seminar required of all freshman students<br>• CTI 101 is required of all freshman students |
| ◆ CTI 101: Success in Technology & Innovation | 1 | | |
| ◆ EGR 101: Introduction to Engineering Design I | 3 | | |
| ◆ MAT 265: Calculus for Engineers I (MA) | 3 | C | |
| ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107: Introduction to Academic Writing or ENG 108: First-Year Composition | 3 | C | |
| Term hours subtotal: | 14 | | |

| **Term 2** 15 - 30 Credit Hours **Critical course signified by** ◆ | **Hours** | **Minimum Grade** | **Notes** |
|---|---|---|---|
| ◆ EGR 102: Introduction to Engineering Design II | 3 | | |
| ◆ MAT 266: Calculus for Engineers II (MA) | 3 | C | |
| ◆ PHY 121: University Physics I: Mechanics (SQ) | 3 | | |
| EGR 104: Critical Inquiry in Engineering (L) | 3 | | |
| ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107: Introduction to Academic Writing or ENG 108: First-Year Composition | 3 | C | |
| PHY 122: University Physics Laboratory I (SQ) | 1 | | |
| Complete First-Year Composition requirement. | | | |
| Term hours subtotal: | 16 | | |

| **Term 3** 31 - 45 Credit Hours **Critical course signified by** ◆ | **Hours** | **Minimum Grade** | **Notes** |
|---|---|---|---|
| ◆ EGR 201: Fall Multidisciplinary Project | 3 | | |
| ◆ EGR 216: Fundamentals of Engineering Systems I | 3 | | |
| ◆ EGR 280: Engineering Statistics (CS) | 3 | | |
| EGR 218: Materials and Manufacturing Processes | 3 | | |
| MAT 275: Modern Differential Equations (MA) | 3 | | |
| Term hours subtotal: | 15 | | |

| **Term 4** 46 - 60 Credit Hours **Critical course signified by** ◆ | **Hours** | **Minimum Grade** | **Notes** |
|---|---|---|---|
| ◆ EGR 202: Spring Multidisciplinary Project | 3 | | |
| ◆ EGR 217: Fundamentals of Eng Systems II | 3 | | |
| ◆ MAT 267: Calculus for Engineers III (MA) | 3 | | |
| 2** Humanities, Fine Arts and Design (HU) | 3 | | |
| EGR 219: Computational Modeling of Engineering Systems | 3 | | |
| Complete EGR 202 AND EGR 217 AND EGR 280 course(s). | | | |
| Complete Mathematics (MA) requirement. | | | |
| Term hours subtotal: | 15 | | |

| **Term 5** 61 - 75 Credit Hours **Necessary course signified by** ★ | **Hours** | **Minimum Grade** | **Notes** |
|---|---|---|---|
| ★ EGR 301: Fall Concentration Project | 3 | | |
| EGR 381: Manufacturing Processes and Validation Lab | 3 | | |
| EGR 382: Modeling of Manufacturing Systems I | 3 | | |
| EGR 383: Communications in a Production Environment | 3 | | |
| HST 318: History of Engineering ((L or SB) & G) | 3 | | |
| Term hours subtotal: | 15 | | |

| **Term 6** 76 - 90 Credit Hours Necessary course signified by ☆ | Hours | Minimum Grade | Notes |
|---|---|---|---|
| ☆ EGR 302: Spring Concentration Project | 3 | | |
| ☆ EGR 385: Design for Manufacturing | 3 | | |
| ☆ EGR 387: Industrial Automation | 3 | | |
| ☆ Complete EGR 301 AND EGR 302 course(s). | | | |
| 2nd Social and Behavioral Sciences (SB) AND Historical Awareness (H) | 3 | | |
| Upper Division Track Focus Elective Course | 3 | | |
| Term hours subtotal: | 15 | | |

| **Term 7** 91 - 105 Credit Hours Necessary course signified by ☆ | Hours | Minimum Grade | Notes |
|---|---|---|---|
| ☆ EGR 401: Engineering Capstone Project I (L) | 3 | | |
| ☆ EGR 481: Manufacturing Econometrics | 3 | | |
| ☆ EGR 482: Materials Science in Manufacturing | 4 | | |
| EGR 485: Engineering Internship | 2 | | |
| Humanities, Fine Arts and Design (HU) AND Cultural Diversity in the U.S. (C) | 3 | | |
| Term hours subtotal: | 15 | | |

| **Term 8** 106 - 120 Credit Hours Necessary course signified by ☆ | Hours | Minimum Grade | Notes |
|---|---|---|---|
| ☆ EGR 402: Engineering Capstone Project II | 3 | | |
| ☆ EGR 480: Advanced Statistical Approaches for Manufacturing | 3 | | |
| EGR 483: Manufacturing Systems Operations | 3 | | |
| Upper Division Social and Behavioral Sciences (SB) **OR** Upper Division Humanities, Fine Arts and Design (HU) | 3 | | |
| Upper Division Track Focus Elective Course | 3 | | |
| Term hours subtotal: | 15 | | |

- Choose one course in respective term for a total of six credits

Technical Electives

EGR 386: Integrated Circuit Manufacturing

EGR 486: CNC Computer Programming

EGR 487: Casting and Forming Processes

EGR 488: Plasma Processing

**Total Hours:** 120
**Upper Division Hours:** 45 minimum
**Major GPA:** 2.00 minimum
**Cumulative GPA:** 2.00 minimum
**Total hrs at ASU:** 30 minimum
**Hrs Resident Credit for Academic Recognition:** 56 minimum
**Total Community College Hrs:** 64 maximum

**General University Requirements Legend**

General Studies Core Requirements:

- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Fine Arts and Design (HU)
- Social and Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

General Studies Awareness Requirements:

- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

First-Year Composition

General Studies designations listed on the major map are current for the 2013 - 2014 academic year.

**From:** Mitzi Montoya
**To:** Scott Danielson
**Subject:** Re: BS in Manufacturing Engineering Proposal Approval
**Date:** Wednesday, January 16, 2013 6:29:06 PM

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Approved.

*Mitzi Montoya*
*Sent from my DROID*

Scott Danielson <Scott.Danielson@asu.edu> wrote:

Dean Montoya,

I am asking for your approval on the attached proposal for a BS in Manufacturing Engineering to be offered in the College of Technology and Innovation at the Polytechnic campus. Your approval is needed before I can send the proposal forward to the Provost's office.

Your approval indicates that the proposal has been approved by the Department and College levels of review and the College has the resources to offer this degree program. Thus, you recommend implementation of the proposed degree program.

Thank you.

Scott Danielson, Ph.D., P.E.
Associate Dean for Academic Programs
College of Technology and Innovation
Arizona State University
480-727-1185

**From:** James Collofello
**To:** Scott Danielson
**Subject:** RE: BS in Manufacturing Engineering
**Date:** Wednesday, January 09, 2013 4:46:15 PM

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Scott,

The engineering school does not have any concerns regarding this proposal.

jim

James S. Collofello
Associate Dean of Academic and Student Affairs
Professor of Computer Science and Engineering
School of Computing Informatics and Decision Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University

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**From:** Scott Danielson
**Sent:** Monday, December 31, 2012 3:39 PM
**To:** James Collofello
**Cc:** Chell Roberts
**Subject:** BS in Manufacturing Engineering

Jim,

I hope you had a good Christmas and will have a Happy New Year!

Attached is the guts of the proposal for the BS in Manufacturing Engineering degree to replace the existing BS in Manufacturing Engineering Technology. (We were directed to do a new degree proposal instead of a rename of the existing degree.)

We would appreciate a statement of support from the Fulton School of Engineering for this new degree. If there are any questions or concerns, please do not hesitate to contact me.

Thank you.

Scott

Scott Danielson, Ph.D., P.E.
Associate Dean for Academic Programs
College of Technology and Innovation
Arizona State University
480-727-1185