Part A

1. **List of Program Learning Outcomes (PLOs)**

The PLO’s shown here are for the on-campus program. The off-campus program has the same PLO’s. The only difference is that areas of focus for item #3 all relate to Lockheed Martin applications.

Graduates shall have

1. A strong foundation beyond the undergraduate level in their chosen focus area as well as in mathematics, basic science and engineering fundamentals, to successfully compete for technical engineering positions in the local, national and global engineering market, advance in their current position or pursue doctoral studies.
2. Contemporary professional and lifelong learning skills to be able to apply theory to solve practical engineering problems.
3. The expertise necessary to perform design and/or analysis of mechanical engineering systems with possible specialization in areas such as: energy systems, electronics cooling, electronics packaging & reliability, finite element analysis, computer-aided design, mechatronics, microelectromechanical systems, product design, robotics, automation & manufacturing.
4. Strong verbal and written communication skills, including the ability to read, write, and comprehend technical documents.
5. Ability to think and work independently to perform design and in-depth analysis in solving open-ended mechanical engineering problems.

These outcomes were developed through numerous faculty discussions and a discussion with our Department Advisory Council. While ABET is only used to accredit undergraduate programs, the Student Learning Outcomes required by ABET were used to inform the development of these MSME Educational Outcomes. Additional feedback was solicited from our alumni via surveys, as well as from our Department Advisory Council, which discussed this during their recent meeting on April 25, 2016.
2. **Map of PLOs to University Learning Goals (ULGs)**

Table 1 shows the relationship between the Educational Outcomes and the University Learning Goals. The map shows good coverage of four of the five ULG’s. The last goal, related to social and global responsibility, is not explicitly covered in the Educational Outcomes. However, good design is not done in a vacuum and must address social and/or global needs.

<table>
<thead>
<tr>
<th>University Learning Goal</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
<th>Outcome 4</th>
<th>Outcome 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized Knowledge</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Broad Integrative Knowledge</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intellectual Skills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Applied Knowledge</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social/Global Responsibilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **Alignment – Matrix of PLOs to Courses**

All instructors teaching off-site are required to assess the learning objectives of each course. In this program, all students take all courses together, one at a time, in a cohort style.

<table>
<thead>
<tr>
<th>Program Learning Outcomes</th>
<th>ME 230</th>
<th>ME 265</th>
<th>ME 273</th>
<th>ME 297</th>
<th>AE 270</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technical Foundation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Lifelong Learning Skills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Specialized Expertise</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4. Communication Skills</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Independence in Discipline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Learning Outcomes</th>
<th>ME 260</th>
<th>ME 243</th>
<th>ME 280</th>
<th>ME 295a/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technical Foundation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Lifelong Learning Skills</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Specialized Expertise</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4. Communication Skills</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Independence in Discipline</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

4. **Planning – Assessment Schedule**

Because this program is offered in a cohort style, only one course is offered at a time. The PLO’s for that particular course are assessed at the time of offering.

- 2016—ME 230, 265, 273
- 2017 – ME 297, AE 270, ME 260
- 2018 – ME 243, ME 295a, ME 280
- 2019 – ME 295b

If there is sufficient interest, we will begin a new cohort later in 2019.

5. **Student Experience**

[http://www.sjsu.edu/me/programs/msme/index.html](http://www.sjsu.edu/me/programs/msme/index.html)

- a. How are your PLOs and the ULGs communicated to students, e.g. websites, syllabi,
promotional material, etc.?

The MSME Educational Outcomes are included on our department website but not the website specific to the Lockheed program. It would be good for us to add a link to that website as well.

b. Do students have an opportunity to provide feedback regarding your PLOs and/or the assessment process? If so, please briefly elaborate.

Feedback from alumni was incorporated into the development of the outcomes but not current students.

Part B

6. Assessment Data and Results

For all courses, both indirect and direct assessment of learning outcomes are performed. Direct assessment is done by homework, exam questions, and project results. Indirect assessment is performed by student surveys that ask students to gauge the importance and their achievement of each learning outcome.

More detailed feedback, including a list of course learning outcomes for each course, is available for each course upon request.

**ME 230: Advanced Mechanical Engineering Analysis**
Direct assessment: 70-95% of students met or exceeded expectations for the five learning outcomes. All learning outcomes related directly to PLO 1.
Indirect assessment: Students gauged the importance of the learning outcomes from 3.4-4.3 on a 5-point scale (5 being very important) and their achievement from 3.5-4.3.

**ME 265: Computer Aided ME Design**
Direct assessment:
PEO 1: 90% of students met or exceeded expectations (CLO 1 – 90%, 2 – 90%, 4 – average score only available)
PEO 2: 90% of students met or exceeded expectations (CLO 2 – 90%, 5 – average score only available)
PEO 3: 90% of students met or exceeded expectations (CLO 2 – 90%, 3 – 86%)
PEO 4: 76% of students met or exceeded expectations (CLO 6 – 100%, 7 – 76%)
PEO 5: project report – 86% of students met or exceeded expectations (relates to CLO’s 2 and 3)
Indirect assessment: Students gauged the importance of the learning outcomes from 3.6-4.6 on a 5-point scale (5 being very important) and their achievement from 3.75-4.47.

**ME 273 Finite Element Analysis**
Direct assessment:
PEO 1: For five graded elements related to PEO 1 (CLO’s 1-4), a range of 77-100% met or exceeded expectations.
PEO 2: For the four graded elements related to PEO 2 (CLO 8), a range of 92.3-100% of students met or exceeded expectations.
PEO 3: For the four graded elements related to PEO 2 (CLO’s 5-7), a range of 92.3-100% of students met or exceeded expectations.
Indirect assessment: Students gauged the importance of the learning outcomes from 4.0-4.9 on a 5-point scale (5 being very important) and their achievement from 3.8-4.8.

7. Analysis
This is a very rigorous program, and overall the students are committed and have a good background to succeed in the courses. All students are full-time employees at Lockheed Martin. Sometimes the travel requirements and heavy workload demands make it difficult for students to complete the same amount of work as traditional students on campus. Students are making good progress towards achievement of the PEO’s, although only one class covered PEO 4 (communication) and PEO 5 (independence in discipline). Greater achievement of those two PEO’s, in particular, will be seen once students complete ME 295a/b, their MS projects.

8. Proposed changes and goals (if any)
The following recommendations were made:

ME 230
- Both the instructors and students felt that a 4-hour class once a week was too much. They recommended increasing the length of the course and breaking up the class into sessions of shorter length
  - Starting with the middle of ME 273, we reduced class length to three hours, with one hour of online office hours later in the week. Students preferred this schedule to the 4-hour block. Starting with ME 260, we plan to increase the length of classes from 11 to 13 weeks.

ME 265
- The instructor recommended spending more time on concurrent engineering design and engineering analysis. We will have to meet to discuss this before the next offering of the class, to determine how to fit these extra discussions in.
- He also recommended spending more time on how to write a technical report.
  - Starting in Spring 2017, our department has hired a student assistant to provide more feedback to students about their technical writing and is considering development of some online materials about technical writing to complement the technical course content.

ME 273
- As mentioned under ME 230, the four-hour class was felt to be too demanding, and the instructor switched to a 3-hour class plus one hour of online office hours on Thursday to help with the homework and projects.
- The software that was planned (ANSYS) could not be installed on students’ laptops due to budget constraints. This issue should be discussed with Lockheed and the instructor well in advance of the next class. As a backup, they used CREO since that was available to all students.

Part C
(This table should be reviewed and updated each year, ultimately providing a cycle-long record of your efforts to improve student outcomes as a result of your assessment efforts. Each row should represent a single proposed change or goal. Each proposed change should be reviewed and updated yearly so as to create a record of your department’s efforts. Please add rows to the table as needed.)
<table>
<thead>
<tr>
<th>Proposed Changes and Goals</th>
<th>Status Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add link to PEO’s and main ME program websites to Lockheed Martin MSME website.</td>
<td></td>
</tr>
<tr>
<td>Switch to shorter class period (not four hours)</td>
<td>Started with switching to 3 hours on Tues and 1 hour on Thurs. for ⅔ of ME 273 as well as AE 270. In Fall 2017 we will extend classes by 2 weeks, from 11 to 13.</td>
</tr>
<tr>
<td>ME 265: Spend more time on concurrent engineering design and engineering analysis.</td>
<td>Review before next offering, possibly in Fall 2019.</td>
</tr>
<tr>
<td>ME 265: Include more guidance to students on technical writing.</td>
<td>Beginning Spring 2017, we’re hiring a student assistant to provide writing feedback via Canvas for the on-campus program. A similar setup will be used for the off-campus program.</td>
</tr>
</tbody>
</table>