

Summary of all SOs assessment results (Rubric scores out of 4) since T152.

Student Outcome	Assessment Courses	Direct Assessment Results
Outcomes (a-k) – from T161-T172		
(a) Apply knowledge of mathematics, science, and engineering.	Not Assessed in this period	This outcome is usually assessed along with SO <i>e</i> using specially-developed exam/assignment questions that require students to use Math/Physics concepts along with the COE course's specific knowledge to solve. Last time this was assessed was in T132 when over 90% of the students achieved satisfactory scores in all outcome indicators.
(b) Design and conduct experiments	COE 344 Lab	This outcome is usually assessed in labs. Assessment is based on how students conduct experiments, judge whether the results are correct, and his ability to design small experiments to debug a system or verify some information. This SO was assessed in T161: Though the sample size was small (6 students), 5 of them could clearly formulate goals for experiments. 4 of them showed that they could design experiments very well, determine appropriate setup, and analyze the resulting data. Two students had some weaknesses in these aspects.
(c) Design a system, component, or process	COE 301 and COE 485	This outcome is assessed based on final project reports/COOP/Summer Training final reports where students have to document their design work, and the process/factors they used/considered to reach the final design. It was assessed in T161: Assessment results from both courses indicated that all the students could formulate the product requirements (i.e. users' needs) and translate that to specs and design goals. However, about 40% had problems when it came to considering different design alternative taking into account economic factors. These students had not taken any course on Engineering Economics, which may explain why.
(d) Function on multi-disciplinary teams	Not Assessed in this period	This outcome is assessed by instructors based on his own observation of students forming teams, planning the work, and supporting one another in carrying out their tasks. Last time this SO was assessed was in T132 and assessment showed that almost all students worked well within a team. Some students (excellent ones) had difficulty understanding the importance of supporting their team mates (and just wanted to focus on their tasks).
(e) Identify, formulate, and solve engineering problems	Not Assessed in this period	(Assessed in conjunction with SO <i>a</i>) Last time assessed was in (T132) where almost all students demonstrated a good ability to formulate and solve open-ended engineering problems.

(f) Understanding professional and ethical responsibility	COE 351 and COE 300	<p>This outcome is assessed along with SOs <i>j</i> and <i>h</i> in two ways: in COE 485 based on instructor observation of students, the way they consider different ethical issues in the design and documentation of their projects, and the impact of their different design decisions. In other courses, in addition to the above, students are also presented special hypothetical situations that may arise in professional life, and represent ethical dilemmas (bribes, conflicts of interest, conflicts between an employer's interest and public interest/welfare etc.). Students are then assessed based on their proposed responses. This outcome was last assessed in T172. There was a great disparity in scores. 20% of the students showed very little understanding of their professional and ethical responsibilities in the work place. However, 80% showed Good-to-Excellent understanding (scores >3).</p> <p>Most students who scored less than 2.5 were weak students who opted for COOP to improve their employability prospects.</p>
(g) Communicate effectively (Oral & Written)	Not Assessed in this period	<p>This outcome is assessed based on Final Reports and Presentations. For each method of communication, students are assessed based on content, language, and organization. They are also assessed based on how they understand the questions directed to them. The last time this SO was assessed was in T141 where results showed that a majority of students had good-to-excellent oral communication skills. However, when it came to written communication, many students showed weaknesses with organization, illustration, and even basic punctuation.</p>
(h) Understand impact of engineering solutions (global and societal contexts)	COE 300 and COE 485	<p>(Assessed in conjunction with SOs <i>f</i> & <i>j</i>) This outcome was last assessed in T172. Even though assessment results were significantly lower in COE 300 (showing marginal satisfaction), the results of the senior design project (COE 485) showed that almost all the students understood the impact of engineering solutions very well (scores above 2.5/4). This showed that this outcome is well achieved as students mature and carry out several design projects of their own.</p>
(i) Recognition and ability for life-long learning	COE 351	<p>This outcome is assessed based on the final COOP/Summer Training (and sometimes COE 485 final project report). Students are assessed based on things they learned on their own and their appreciation for the need to do so. This outcome was last assessed in T172. The sample size used was relatively small (7 students) and most of them were weak students who opted for COOP to improve their employability prospects. 70% of the students had problems with critical thinking and decision-making skills. These skills need to be improved. Still, almost all of the students did recognize the importance of continuous self-learning.</p>
(j) knowledge of contemporary issues	COE 300 and COE 485	<p>(Assessed in conjunction with SOs <i>f</i> & <i>h</i>) This outcome was last assessed in T172. 90% of students showed Good to Excellent knowledge of contemporary issues (i.e. scores >3), both at the local and global level.</p>
(k) Use of techniques, skills, and modern engineering tools	COE 444, COE 485 and COE 351	<p>This SO is usually assessed with SO <i>c</i>. It is assessed based on final project/coop/summer training reports. Students are assessed on the tools and techniques they use in their design work. This SO was assessed in T161. Assessment results from three courses indicated that a vast majority do well with using appropriate techniques and tools to do different jobs; however, many did not provide good justification for their selections. They seemed to use whatever tools they were accustomed to.</p>

Outcomes (1-7) – from T181-T201

<p>1) Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.</p>	<p>COE 241 Data Communications, COE 306 Embedded Systems, and 485 Senior Design Project</p>	<p>This SO was assessed in T181, T201, and T202. This outcome is usually assessed using especially-developed exam/assignment questions that represent complex engineering problems, and require students to use Math/Physics concepts along with the COE course-specific knowledge to solve.</p> <p>In T181, assessment results in COE 241 and COE 306 showed that this outcome was clearly achieved by the vast majority of students. Some low performing students in COE 306 (who have missed many course assignments or quizzes) achieved low scores. In COE 241, problems used to assess this outcome required understanding and utilizing a number of relationships governing many physical system parameters. Most students seem to have been able to capture and apply the concepts effectively. In COE 485, however, the batch of students (12 in total) were significantly below the average of previous batches. Assessment results in COE 485 showed that ~40% of the students had problems formulating problems, coming up with specs and constraints and selecting an appropriate solution. This outcome was deemed marginally satisfied by that batch of COE 485 students.</p> <p>In T201, this outcome was only assessed in COE 241 and COE 306 (as COE 485 was used to assess several other SOs). Assessment results in COE 241 showed that the majority of students (~70%) had serious issues in formulation and identification of problems, but they showed better performance in solving problems using engineering methods. The obvious reasons for this is that this course was taken by sophomores who seem to be more impacted by the on-line teaching than juniors. Assessment results in COE 306 (taken by junior students) showed better achievement of this outcome as ~75-80% of the students achieved >2.5/4 scores in the rubrics. The program assessment committee worked with the COE 241 instructors to identify how improve problem identification, formulation, and solving in the course and how to better assess it.</p> <p>SO1 was assessed again in COE 241 in T202 using a homework problem where students had to assess several options for a link design and select the best option. 80% of the assessed students were successful in identifying the problem and the systematic approaches to solve it and properly formulated the problem. However, when it came to considering alternative approaches (and the justification), many students (40%) did not document that. The instructors believe that these students simply cannot communicate their thoughts and ideas (mostly sophomore). The communication hurdles are compounded by the Covid-19 situation and the on-line teaching. This SO was considered satisfied. As students mature in the program, they show improved communication skills and proper consideration and justification of the different approaches they consider when solving a problem.</p>
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<p>2) Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.</p>	<p>COE 351 COOP, COE 405, COE 444, and COE 485</p>	<p>This SO was assessed in T182, T201, and T202. This outcome is assessed based on final project reports/COOP/Summer Training final reports where students have to document their design work, and the process/factors they used/considered to reach the final design.</p> <p>In T182, SO2 was assessed in COE 351 (COOP) and COE 485. In COE 351, all but the Approach Selection outcome indicators were satisfactorily achieved by students (i.e. more than 70% achieved 2.5/4 or more scores). ~40% of students performed poorly when it came to examining different approaches for the design, and making a selection with proper justification. In COE 485 (senior design project), more than 90% of the students achieved all five SO2 performance indicators, indicating strength in all aspects of design.</p> <p>In T201, SO2 was assessed in COE 351 (COOP), COE 399 (summer training), COE 405 (Design and Modeling of Digital Systems), COE 444 (Internetwork Design and Management), and COE 485 (senior design project). The five SO2 performance indicators were achieved by more than 70% of students who scored above 2.5/4 in two courses: COE 399 (Summer Training) and COE 405. In COE 485 (Senior Design Project), only 60% of the students achieved the five SO2 indicators, indicating weakness in all aspects of design. Lockdown and on-line teaching significantly impacted students in COE 485 as they were overwhelmed with project tasks with team members spread all over the country. In COE 444, two out of five performance indicators were achieved by more than 70% of students. These were “Detailed Design” and “Prototyping”. However, students showed weakness in “Requirements and Specifications”, “Approach Selection”, and “System Design”. The PAC committee realized that the way SO2 was assessed in COE 444 was not ideal, and the instructor agreed to properly re-assess this outcome in the next semester. In COE 351, only three students took the COOP and only one of them achieved the SO2 outcome. Again, due to lockdown, these students did their work independently from home which impacted them greatly.</p> <p>SO2 was assessed again in COE 444 in T202. This time, the instructor emphasized the different aspects of design and requested a specific template for the project report. Assessment results showed significant improvements where all indicators of this SO were satisfied (> 70% of the students achieved scores of 60% or more). Still, one of the indicators, identifying and following a logical and orderly design procedure, was not satisfied. Students seem to follow the first ‘obvious’ design option they come up with. In the future, the instructor is going to ask the students to show all the steps the design process and justify every decision they made. Students will also be required to conduct more test cases with different scenarios to make sure they satisfy all the requirements.</p>
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<p>3) Ability to communicate effectively with a range of audiences.</p>	<p>COE 399 Summer Training, COE 351 COOP, and COE 485</p>	<p>This outcome is assessed based on Final Reports and Presentations. For each method of communication, students are assessed based on contents, language, and organization. They are also assessed based on how they understand the questions directed to them. This SO was assessed in T181 and T201.</p> <p>In T181, SO3 was assessed in COE 351 (COOP), COE 399 (Summer Training), and COE 485 (senior design project). Assessment results in COE 351 and COE 399 showed that more than 70% of the students scored at least 2.6/4 for each of rubric indicator (indicating satisfactory achievement of SO3 in these two courses). However, over 70% of COE 485 students failed to achieve any of the rubric indicators (i.e. the outcome was not satisfied). Students had serious problems organizing and communicating their thoughts, ideas, and efforts. This batch of students was significantly below the average of previous batches. In T182, COE faculty members were informed of the issue of declining communication ability of COE students and were asked to give more assignments that require writing and presenting students ideas, and to give feedback to students on their communication skills.</p> <p>In T191, SO3 was assessed again in COE 485 to see the effect of the proposed corrective actions in T182. Assessment results showed that some aspects of the oral communications (e.g. “<i>Presentation Organization</i>”) indicators were achieved by at least 70% of the students, however still ~40% of the students did not achieve any other indicators of oral presentation skills, deeming this aspect of SO3 marginally achieved. On the other hand, over 70% of the students were unable to achieve any of the written communication indicators, indicating that this aspect of SO3 needs improvement. Even though there was a slight improvement in SO3 assessment results, students still had serious problem organizing and communicating their thoughts, ideas, and efforts. Another set of corrective actions were launched in T202. This outcome is to be assessed again in the near future.</p>
<p>4) Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic,</p>	<p>COE 300 Principles of COE Design, COE 351, and COE 485</p>	<p>This outcome is assessed in two ways: in COE 485 based on the instructor’s observation of students, the way they consider different ethical issues in the design and documentation of their projects, and the impact of their different design decisions. In other courses, in addition to the above, students are also presented special hypothetical situations that may arise in professional life, and represent ethical dilemmas (bribes, conflicts of interest, conflicts between an employer’s interest and public interest/welfare etc.). Students are then assessed based on their proposed responses. This SO was assessed in T182 and T201.</p> <p>In T182, SO4 was assessed in COE 300 (Intro. to COE Design), COE 351 (COOP), and COE 485 (senior design project). Assessment results in COE 300 showed that a majority of students (~70%) had problems in every indicator of the rubrics. That batch of students was significantly below the average. The COE 300 instructor was advised to include more material on this SO in the course. On the other hand, all the students in COE 351 (8 students) and over 90% of the students in COE 485 achieved satisfactory results (>2.5/4) in all indicators of this SO. This shows that as students proceed through the COE program, they have better attainment of this</p>

<p>environmental, and societal contexts.</p>		<p>outcome. Still a major issue with this outcome is that students seldom do any extracurricular reading. Hence, their knowledge of current global and contemporary issues is very limited.</p> <p>In T201, SO4 was assessed in COE 300 (Intro. to COE Design), COE 351 (COOP), COE 399 (Summer Training), and COE 485 (senior design project). Assessment results in COE 300, COE 351, and COE 351 showed that many students (~70%) had deficiencies in all indicators of this SO. On the other hand, assessment results in COE 485 showed that a majority of students (~80%) achieved 3 or more on all indicators of this SO. Upon closer examination by the program assessment committee (PAC) of the hypothetical test case used to assess this SO in the 1st three courses (by the same instructor), the test case was deemed extremely inappropriate in that it required special training (like what new employees get in a company). Students' training in the program would not have prepared them for such a case (nor would anyone who did not receive special training on such issues). As such, it was decided to assess this outcome again in T202 in COE 300 and COE 351.</p> <p>SO4 was assessed again in COE 300 in T202. after the instructor had implemented the recommendations from the previous semester. This time the overwhelming majority (>80) of students had satisfactory scores in all indicators of this SO.</p>
<p>5) Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.</p>	<p>COE 300, COE 399 Summer Training, and COE 351</p>	<p>This outcome is assessed by the instructor based on his own observation of the students in forming teams, planning work, and supporting one another in carrying out their tasks. This SO was assessed in T181 and T201.</p> <p>In T181, SO5 was assessed in COE 300 (Introduction to COE Design), COE 351 (COOP), COE 399 (Summer Training), and COE 485 (Senior design project). More than 70% of COE 399 and COE 300 students scored at least 2.5/4 for each of the rubric indicators. In COE 485, most students showed acceptable performance in all indicators except for the leadership-related indicator. Some students had serious problem with managing tasks, leading tasks, or even interacting with their team at any level. There were only 5 students in COE 351, 2 of them attained poor scores (2/4) across all indicators. The other 3 students had scores above 3/4.</p> <p>In T201, SO5 was assessed again in the same set of courses. More than 70% of COE 399 students scored at least 2.5/4 in the <i>working with others</i> and the <i>teamwork</i> indicators. However, <i>contributions</i> and <i>problem-solving</i> indicators show that students fell short of showing evidence that majority of students attained them, since about half of the class scored less than 2.5/4. In the other 3 courses, assessment results showed that none of the outcome indicators were achieved (more than 30% of the students failed to reach the 2.5/4 level). The PAC believes that these results were greatly impacted by lockdown conditions. This SO has to be assessed again once normal on-campus teaching has resumed.</p>

<p>6) Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.</p>	<p>COE 301 Computer Organization, and COE 306 labs</p>	<p>This outcome is usually assessed in labs. Assessment is based on how students conduct experiments, judge whether the results are correct, and design small experiments to debug a system or verify some information. This SO was assessed in T182, T201, and T202. In T182, SO6 was assessed in COE 301 (Comp. Organization) and COE 306 (Embedded Systems) labs. Both “<i>Designing a valid and appropriate experimental setup</i>” and “<i>Conducting the experiment</i>” indicators were achieved by more than 70% of COE 301 lab students. However, the “<i>Pre-Experiment</i>” and “<i>Analyzing and interpreting data</i>” indicators were not achieved by at least 70% of COE 301 lab students indicating a need for improvement. On the other hand, “<i>Designing a valid and appropriate experimental setup</i>”, “<i>Conducting the experiment</i>”, and “<i>Analyzing and interpreting data</i>” indicators were achieved by only 67% of COE 306 lab students, indicating marginal satisfaction. The remaining indicator, “<i>Pre-Experiment</i>” indicator was achieved by more than 70% of students.</p> <p>In T201, SO6 was also assessed in COE 344 (Computer Networks) lab in addition to COE 301 and COE 306 labs. While more than 70% of COE 301 lab students scored at least 2.6/4 for each of rubric indicators (indicating full achievement of SO6), none of these indicators were achieved by at least 70% of COE 306 and COE 334 lab students, indicating a need for improvement. Upon analysis of assessment procedures/data of these two labs, it became apparent that a major contributing factor to not achieving the outcome was the COVID-19 pandemic and the fact that students were performing experiments remotely/virtually with a reduced level of interaction with instructors. Another contributing factor in the COE 344 lab was that assessment was done relatively early in the semester. To be able to design an experiment, a student needs to learn and acquire knowledge of a certain amount of material in computer networking. Most of the topics related to routing, switching, etc. are covered in the last weeks of the semester. During this period, the student is so busy with other courses, labs, exams, and projects that he barely has an opportunity to design or develop ideas pertinent to a particular topic in the lab. Also, it seems that the students’ poor communication skills are impacting the translation of the students’ ideas and designs to proper reports that are the basis for assessing this outcome. The program assessment committee worked with the COE 344 lab instructor to identify how/when to assess SO6 and agreed to re-assess this outcome in the COE 344 lab again in T202.</p> <p>SO6 was assessed again in COE 344 lab in T202. All indicators were achieved by at least 65% of students except for the “<i>Analyzing and interpreting data</i>” indicator which was achieved by only 35% of students. Lab instructor was advised to modify the structure of the lab report can such that each lab task should have 4 sections: procedures, results, proofs, and interpretations and analyses. Furthermore, the interpretations and analyses section should be given a higher weight than the other 3 sections so the students will put more effort to this aspect.</p>
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<p>7) Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.</p>	<p>COE 300 and COE 485</p>	<p>This outcome is assessed based on final COOP/Summer Training reports (and sometimes the COE 485 final project report). Students are assessed based on the things they learned, how they learned them (e.g. did they make conscious decisions to judge the reliability of information they found) on their own and their appreciation for the need to do so. This SO was assessed in T182 and T201.</p> <p>In T182, SO7 was assessed in COE 351 (COOP) and COE 485 (Senior Design project). In each course, more than 70% of the students scored at least 3/4 in all indicators, indicating that this SO was fully satisfied.</p> <p>In T201, SO7 was also assessed in COE 399 as well as COE 351 and COE 485. More than 70% (65% for the <i>selecting appropriate learning strategy</i> indicator in COE 399) of students in the 3 courses scored at least 2.5/4 in all indicators. The PAC concluded that the small number of students (3 students) in COE 399 who had difficulty with self-learning (in isolation) is within the norm and hence this SO was considered achieved.</p>
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