Program Goals and Learning Outcomes

Definitions

Program goals – Broad statements identifying what students should learn, understand, or accomplish, as a result of their studies by the time they finish a program. These goals are **broad in scope and set the higher-level learning goals for all students.**

Program learning outcomes – Statements that describe **measurable** skills and competencies that students have achieved and can demonstrate upon successfully completing a course or set of courses.
Program learning outcomes describe in concrete terms what program goals mean. They identify what students will be able to demonstrate, produce or represent as a result of what and how they have learned in a program. Unlike Program Goals, Program Learning Outcomes are not fixed. They are being developed for a specific and fixed assessment cycle. Assessment results will then be used to make required changes in the curriculum, pedagogies, faculty professional development, student support, or resource allocation. Learning outcomes too could be revised, modified or changed for a subsequent assessment cycle etc.etc.

Course learning outcomes – **Specific** statements that describe **achievement expected within a particular course**. Course learning outcomes relate to topics and assignments in a given course and are measurable.

Example
from Master of Science in Structural Engineering with a Specialization in Structural Health Monitoring and Nondestructive Evaluation

Program Goals:
1) Students will develop a solid understanding of engineering concepts, principles, and theory and will develop the critical thinking skills to apply this knowledge to structural health problems and challenges, and to solve a wide range of technical problems where analysis of situations or data requires an evaluation of a variety of factors with creativity and independence. (Learning Outcomes: 4, 5, 6, 7, 8, 9)
2) Students will gain knowledge of SHM processes, including observation of a system over time, the extraction of damage-sensitive features from these measurements, and will have the statistical skills to analyze these features to determine the current state of system health. (Learning Outcomes:1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)
3) Students will develop the skills to evaluate test design results, interpret data, draw conclusions, and effectively communicate the analysis to other experts as well as non-expert professionals. (Learning Outcomes: 1, 2,3, 5,7, 8, 10, 11,12, 13, 14)
4) Students will develop the skills to research and model engineering problems, identify strategies for measuring and collecting data, interpret data; and, design, test, analyze, verify and validate solutions to those problems. (Learning Outcomes: 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14)

Program Learning Outcomes:
1) Ability to apply the scientific method to execute systematic approaches to problem solving, including problem definition, constraints, solution strategies, and results comparison/assessment.
2) Knowledge and application of the structural health monitoring/nondestructive evaluation (SHM/NDE) statistical pattern recognition paradigm for monitoring strategies.
3) Knowledge of nondestructive evaluation (NDE) techniques for the quantitative characterization of materials and structures (e.g. flaw detection/localization/characterization; geometry/dimension; material properties/coatings)
4) Knowledge of operating principles of primary sensing and networking architectures used in SHM/NDE.
5) Knowledge of structural dynamics theory, test design/execution and signal processing.
6) Knowledge of fundamental structural mechanics of materials (e.g. composites).
7) Knowledge of basic modeling of structural failure mechanisms.
8) Knowledge of finite element analysis for physical modeling (thermal, static, dynamic) with exposure to commercial software (e.g. ABAQUS, COSMOL, or ANSYS, etc.)
9) Knowledge of embedded hardware design.
10) Knowledge in test set-up, instrumentation, and data acquisition, with exposure to commercial DAQ and/or DAQ processing software (e.g. LabVIEW, Matlab, etc.)

11) Ability to critically evaluate modeling assumptions and theory and determining their estimated error and uncertainty on the solution, including formal validation and verification procedures.

12) Ability to exploit signal processing and data analytics/machine learning for extracting information from diverse data sets.

13) Knowledge in formal statistical modeling, probabilistic methods, and risk/reliability.

14) Ability to present and defend assumptions, system design, analysis results, uncertainties, and error estimates at formal model validation or structural health monitoring system design reviews.

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