HINDUSTHAN

INSTITUTE OF TECHNOLOGY

(An Autonomous Instititon)

Department of Computer Science and Engineering

OUTCOME BASED EDUCATION (OBE) - HAND BOOK

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http://hit.edu.in/cse/OBE-handbook.pdf

Preface

The purpose of this document is to provide technical assistance to the Faculty members of Engineering Education, especially Computer Science and Engineering about the need for Outcome Based Education (OBE), various components of OBE, OBE based curriculum, content delivery, assessment methods, measuring attainments, impact analysis and continuous improvement. We try to cover all these concepts with examples for better understanding and implementation. The Outcome Based Education – Hand Book is available at **http://hit.edu.in/cse/OBE-handbook.pdf**

Preparing for OBE Implementation

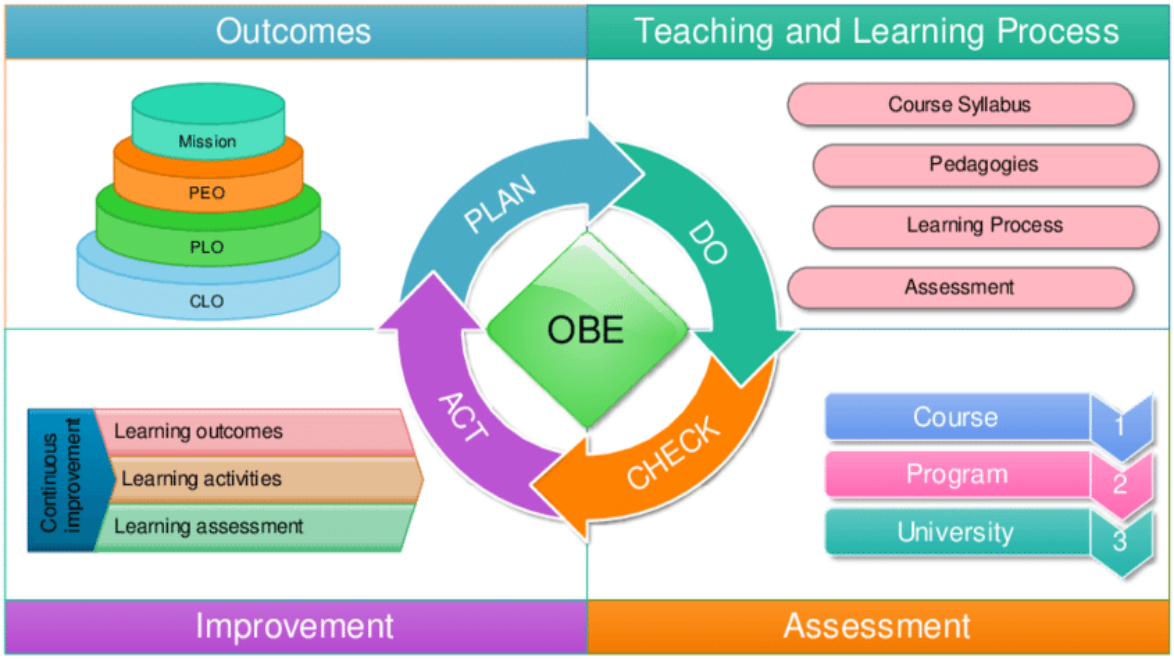
Questions to be Answered:

- What is the Psychological significance of OBE?
- What are the various components of OBE?
- How do you align OBE components such as vision, mission and Programme Educational Objectives?
- How to design course outcome?
- What are the various components involved in evaluating course attainment?
- How higher order thinking is applied in assessment of Course outcome?
- How course outcome attainment is mapped to overall Programme Outcome?

1 Outcome Based Education

Outcome-Based Education (OBE) is a pedagogical model that entails the restructuring of curriculum, pedagogy and assessment practices to reflect the achievement of high-order learning, as opposed to a mere accumulation of course credits. OBE places emphasis on what is learned, and is a student-centric model that incorporates real-world scenarios. OBE is an education system built on specific outcomes. It focuses on the skill sets students to acquire following the completion of their studies. Activities in or outside the classroom are designed in a manner so as to helps students achieve these outcomes. OBE empowers students to choose what they would like to study and how they would like to study it. Not only does it adapt to a learner's strengths and weaknesses, but it also provides sufficient time to attain proficiency and fluency in the subject matter. Various components of OBE process is shown in the figure 1.1

Figure 1.1 OBE Process



1.1 Insitute Vision

"INITIATE, INNOVATE, INCULCATE"

HIT pursues a philosophy of perpetual acquisition of Knowledge. Apart from academic curriculum, equally important is our policy to provide value based education and to exhibit the hidden potentials in students that equip them to approach life with optimism.

1.2 Insitute Mission

Hitech conveys revolutionary technical education and inculcates great outlines of discipline through our dedicated staff, who shall set global standards, making our students technologically superior and ethically strong with the help of state-of–art laboratories in all disciplines.

HITECH focuses in both education and discipline to achieve greater recognition for our efforts. The college will build on its traditions of innovation, problem solving and interdisciplinary collaboration to meet the changing needs of society.

1.3 Key Components and Outcome Levels

OBE comprises of four major components which cover

(1) curriculum design,

(2) teaching and learning methods,

(3) assessment, and

(4) continual improvement

Four levels of outcomes from OBE are:

- Course Outcomes (CO) - Knowledge & skills acquired via course/curriculum
- Program Outcomes (PO) - Expertise developed after completion of the program
- Program Educational Objectives (PEO) - Broader objectives after completion of the program
- Program Specific Outcomes (PSO) - Expertise of graduates of a certain program

1.3.1 Department Vision

Description	Vision statement is dream of where one wants the Deparment to be and inspires all the stake the Institute to be and inspires all the stake holders

Vision

To produce globally competent Computer Science and Engineering graduates through value-based technical education to outperform in the vibrant computing world and adapt to life-long learning.

Formulation	• Brainstorming sessions with stake holders including experts & experienced faculty of the department • Discussion with industry professionals, parents and alumni batches • accepted views are analyzed and reviewed to check the consistency with the vision and mission of the institute
Dissemination	• Academy website • Display in the various class rooms and laboratories. • Student handbooks • Departmental office and notice board • Course file and lab manual
Correlation with Institute Vision	High (3)

1.3.2 Department Mision

Description	Mission statements are actionable statements that guide the stake holders to act and achieve the vision

Mission

MD1: Creating technocrats with strong core competencies in the field of Computer Science and Engineering which serve as the foundation for career.

MD2: Providing the best practical experience and innovative concepts which help them to solve societal issues in ethical manner.

MD3: Providing the value based technical education to specialize in the field of computer science engineering.

Formulation	• Brainstorming sessions with stake holders including experts & experienced faculty of the department • Discussion with industry professionals, parents and alumni batches • Accepted views are analyzed and reviewed to check the consistency with the vision and mission of the institute
Dissemination	• Academy website • Display in the various class rooms and laboratories. • Student handbooks • Departmental office and notice board • Course file and lab manual

Correlation with Institute Mission

Institute	MD1	MD2	MD3
MI1	High	High	High
MI2	High	High	High

1.3.3 Programme Education Objective

Description	Program educational objectives (PEOs) specify the expected outcomes of students once they graduate, mostly the way they conduct their behavior & ethics and excel in their careers.

PEO

PEO1: Graduates will establish themselves as effective computer professionals by solving real world problems using cutting edge technologies of Computer Engineering.

PEO2: Graduates will be inculcated with professional and ethical attitude, team work, effective communication, multi-disciplinary approach with an ability to relate computer engineering issues with social awareness.

PEO3: Graduates will actively pursue graduate studies in advanced areas of computer science and related fields by succeeding in competitive exams.

Formulation

- The Program Coordinator consults with the senior faculty members and prepares a draft mentioning the POs.
- The Program Coordinator also speaks to the students that belong to the Alumni batch, industry representatives, and various employers to understand the requirement of current industry & trends. On analyzing the views, he/she edits the draft and sends it to the Program Assessment Committee.
- The Program Assessment Committee reviews the draft and sends it to the Department Advisory Board to get the final approval from them.
- Department Advisory Board makes the final decision by moderating the draft.

Consistency of PEOs with Mission of the Department

PEO	Mission	Mission correlated level	Justification
PEO1	MD 1	High (3)	By collaborated withindustry, students will train to improve the analytical skills and highly motivating the students to take part in career-oriented activities in the field of computer science and Engineering.
	MD 2	Moderate (2)	By doing research activities students will exhibit ethical value and make a significant contribution towards society.
	MD 3	High	Promotes effective learning and underpins continuous improvement of the personal, social, moral and

			(3)	economic well-being.
	P E O 2	**MD 1**	**Moderate (2)**	Build an assessment instrument to measure the extent to which graduates are able to achieve the necessary skills.
		MD 2	**High (3)**	Graduates are highly motivated to participate in software and hardware contest like hackathon.
		MD 3	**Moderate (2)**	Mandatory courses for ethics and human values will be included in curriculum.
	P E O 3	**MD 1**	**High (3)**	Motivating the students to pursue the higher studies and training on eligibility test like GATE, TANCET, TOEFL, Government Exams.
		MD 2	**High (3)**	Graduates will learn professional engineering solutions for uplifting their skill on preparation of competitive exams like DRDO, ISRO etc.
		MD 3	**Moderate (2)**	Graduates will have the ethical attitude and social responsibility by involving the students to do various innovative projects.

1.3.4 Programme Outcome and Programme Specific Outcome

Description	Program outcomes are defined as the objectives achieved at the end of any specialization or discipline. These attributes are mapped while a student is doing graduation and determined when they get a degree.

POs & PSOs

PO1: ENGINEERING KNOWLEDGE: Ability to apply knowledge of mathematics, Science and Engineering applicable to Computer Science and Engineering discipline.

PO2: PROBLEM ANALYSIS: Ability to analyze and develop solutions to computational problems using appropriate algorithms.

PO3: DESIGN /DEVELOPMENT: Ability to design, implement and evaluate a computational system to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability and sustainability.

PO4: CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS: Ability to apply design and development principles in the construction of software systems of varying complexity and perform testing.

PO5: MODERN TOOL USAGE: Ability to use appropriate techniques, skills, and modern tools to produce quality software products and solutions using Software Engineering principles.

PO6: THE ENGINEER AND SOCIETY: Ability to develop innovative ideas that can be translated into products benefiting the society and the economic growth.

PO7: ENVIRONMENT & SUSTAINABILITY: Ability to assess the impact of engineering practices on societal and environmental sustainability.

PO8: ETHICS: Ability to understand and apply professional, ethical, security, social issues and responsibilities for the computing profession.

PO9: INDIVIDUAL AND TEAM WORK: Ability to function effectively as individuals and as a member of a team to share computing design, assessment or implementation of a common goal.

PO10: COMMUNICATION: Ability to communicate, write effective reports, design documentation and make effective presentations.

PO11: PROJECT MANAGEMENT AND FINANCE: Ability to work with good engineering and managerial skills and teamwork for successful completion of projects.

PO12: LIFE LONG LEARNING: Ability to recognize the need and an ability to engage in life-long learning.

PSO 1: Ability to understand and analyze the real world computational problems and to develop solutions by applying mathematical logic, appropriate data structures and algorithms.

PSO 2: Ability to become a successful software engineer by creating and using modern IT tools.

PSO 3: Graduate will have communication and leadership skills to endure themselves working as a member or managing a team.

1.3.5 Course Outcome

Description	Course outcomes are the statements of what a student should know, understand and/or be able to demonstrate after completion of a course. While writing COs for a course, please remember the following points.
CO-PO Course Articulation Matrix	Course Articulation Matrix shows the educational relationship (Level of Learning achieved) between Course Outcomes and Program Outcomes for a Course. This matrix strongly indicates whether the students are able to achieve the course learning objectives. The matrix can be used for any course and is a good way to evaluate a course syllabus.

Sample Course Outcome

COURSE NAME: DATA STRUCTURES

COURSE CODE: 20CS401

SEMESTER: III

At the end of the course, the student should be able to

- CO1 To implement and perform various operations using arrays.
- CO2 To explain and implement real time applications using linear data structures.
- CO3 To experiment various applications using tree data structures
- CO4 To apply graph algorithms for variety of real time problems.
- CO5 To implement basic sorting and searching algorithms
- CO6 To illustrate various hashing techniques.

Sample CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO1	3	2	2	-	-	1	-	-	-	-	-	1
CO2	3	2	2	2	1	1	-	-	-	-	-	1
CO3	3	3	3	2	1	1	-	-	-	1	-	1
CO4	3	3	3	2	1	1	-	-	-	2	-	1
CO5	3	2	2	1	1	-	-	-	-	1	-	1
CO6	3	3	3	2	1	1						1

Sample CO-PSO Mapping

CO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	3	-	1
CO3	3	1	-
CO4	2	-	1
CO5	1	-	-
CO6	-	-	-

2 OBE Course Design and Delivery

The efficiency of an OBE system to a greater extent depends on how well the curriculum is managed and delivered. Drilling down to the course level, it is mandatory that a curricular framework or a course design is needed to assist the teacher and students to navigate through the curricular activities along the right track.

The cardinal principle behind an OBE Course Design is the principle of **constructive alignment**, i.e. streamlining the learning experiences and assessments to the intended learning outcome.

2.1 Steps for developing OBE-enabled course design

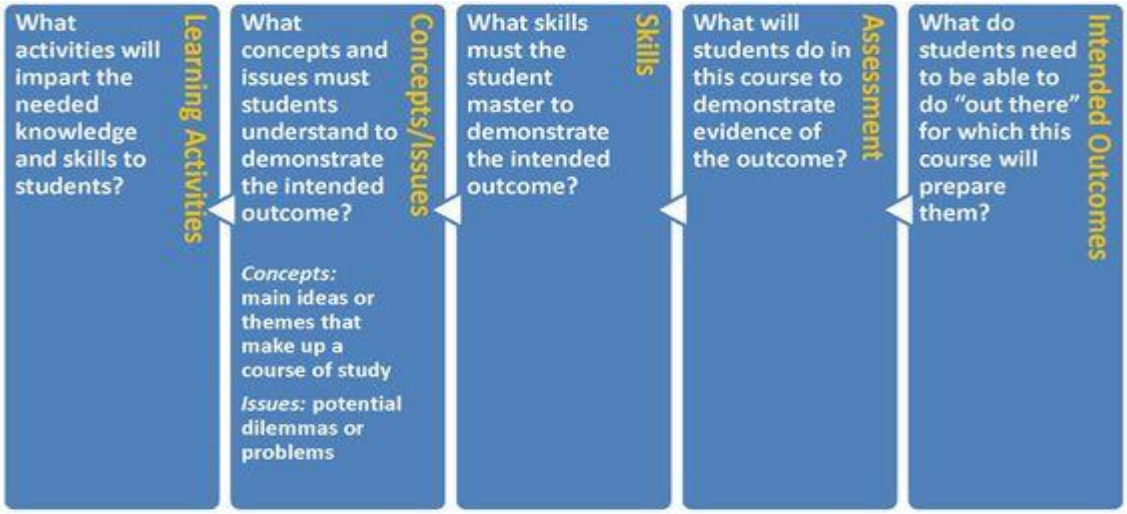
- Gather information about the course content, available resources related to the content, the respective course outcomes, course expectations, and students learning needs.
- Divide the module into functional units or frames and decide upon the intended learning outcomes and performance indicators for the course units.
- Select content, fundamental concepts related to the content, appropriate learning activities, instructional method, support system (media) relevant for the learning environment, and constructive align it to the intended learning outcome (ILO)
- Develop suitable performance indicators (assessment methods) that directly reflect the attainment of the intended learning outcomes.
- Implement the course plan as per the design creating a learning environment for the community of learners (students of the course).
- Revise the plan periodically after the assessment and evaluation based on intended learning outcomes and actual learning outcomes, feedback from the students, peers, and self-reflection.

2.2 Elements to be considered for the success of OBE

- What the students should learn and be able to do on completion of each subunit must be clearly identified.
- Formative assessment tools should be based on demonstrated achievement of the students. Hence proper indicators for the assessment must be identified.
- Diversified instructional and assessment strategies should be formulated to meet the needs of the students.

- Each student should be made to reach the maximum potential by providing sufficient assistance.
- Design the Intended learning outcome based on the course learning outcomes and program outcomes as far as possible.
- Ensure the learning strategies and assessment techniques to be aligned with the learning outcomes. The elements of OBE is shown in Figure 2.1.

Figure 2.1 Elements of OBE



2.3 Designing Course Learning Outcomes

Objectives or outcomes are more specific and are focused on demonstrable or observable steps toward a goal.

- What students should be expected to know or do by the end of the course
- Observable and measurable actions taken by students
- The results or evidence of learning, not the activities performed in pursuit of the learning

Common formula to guide the writing of learning outcomes is **SMART**, an acronym that has many variations:

- **Specific**: clear and focused terms that describe expected skills, knowledge, performance
- **Measurable**: learning can be assessed through data, observation, or other concrete ways
- **Attainable** *or* **Appropriate** *or* **Achievable**: doable within any limits and boundaries of the learner or course level
- **Relevant**: the tasks are relevant to what is to be learned
- **Timebound**: can be accomplished in the time accorded

2.3.1 Aligning Learning Outcomes and Course Learning Activities

Before you even begin to think about creating new learning activities or reviewing and revising existing ones in your course, consider a few of these facts about alignment between outcomes and learning activities:

- Activities and assessments should align with one or more course outcomes.
- An assessment allows students to demonstrate their learning–if not, one needs to revise the assessment.
- A specific learning outcome may be expressed in more than one learning activity while a learning activity may demonstrate more than one outcome.
- A learning activity or assessment may reflect different levels of learning as well.

2.4 Outcome Based Course Outline

Four steps to prepare an outcome based course outline are: Step-1 Introduction, Step-2 Content, Step-3 Assessment, and Step-4 Resources. Every step includes a number of components that needs to be prepared. The major components are mentioned in the diagram above while each component has some sub-items. The template of the course information is available at **http://hit.edu.in/cse/cis-template.docx**

2.4.1 Step-1 Introduction

This step includes the components a. Course information, b. Academic session, c. Course objective, d. Learning outcome, and e. CLO-PO mapping. The template of

- **Course Information** is all about the course itself such as, (i) Course no./code, (ii) Course name/title, (iii) Section/Student group, (iv) Pre-requisite, (v) Credit value, and (vi) Total marks.
- **Academic session** includes other academic information such as, (i) Semester/Trimester, (ii) Course level, and (iii) Course type.
- **Instructor profile** includes short biography of the course instructor who is the developer of the course outline as well.
- **Course objective** includes the description of the course through the following points: (i) Rationale of the course, (ii) Course synopsis, and (iii) Overall and specific objectives.
- **Learning outcome** is the list of students' learning outcomes aligned with the course objectives mentioned earlier. These learning outcomes are called Course Learning Outcomes (CLO) of the course.
- **CLO-PO mapping** includes the mapping of each CLO with one or more program outcomes (PO) listed for the program for which this course is required. Every program has a list of PO's that needs to be achieved by every student at the program completion. Student's attainment level from each course, as the course

grade point, contributes to the cumulative grade point of the program. (More on CLO-PO mapping is discussed in a later section of this article.)

2.4.2 Step-2 Content

This step includes the components a. Topic selection and alignment with CLO, b. Teaching-learning strategy, and c. Class schedule and Lesson Plan.

- **Topic selection and alignment with CLO** is about the subject contents that are planned to teach during the semester/trimester. Each and every topic selected must the aligned with the course objectives and learning outcomes of the course. This process in outcome based course outline is exactly opposite to that of the traditional course outline. Here, subject topics are selected as required according to pre-defined PO's of the program and CLO's of a course.
- **Teaching-learning strategy** is a wide area of considerations of variety of suitable methods for effective teaching and learning. Some effective methods, suitably classified as Andragogy, are accepted for tertiary education. This component in the course outline gives an outline of the teaching methods to be used and process of students' learning. (Teaching learning strategies are discussed in the next article of this series of write-ups.)
- **Class schedule and Lesson Plan** includes the dates and times of lectures during the semester/trimester. Lesson plan is the plan of every class/lecture by day or lecture hours by week. All classes are planned in the lesson plans by a standard format practiced in the institution. (More on Lesson Plan is discussed in a later section of this article.)

2.4.3 Step-3 Assessment

This step includes the components a. Assessment strategy, b. Assessment tool selection, and c. Evaluation policy and grading.

- **Assessment strategy** is the selection of an appropriate method of evaluating students' performance for the course. There are various methods of students' performance evaluation, which are independently effective for different courses. Usually, there is a final exam policy for a course at the end of semester/trimester that is considered as summative assessment. Moreover, some more exams and other means of evaluation can be used as part of formative assessment. (Assessment strategies are discussed in the next article of this series of write-ups.)
- **Assessment tool selection** includes the list of assessment tools that are intended to use for this course during its time period. The assessment tolls can be quiz, class test, assignment, report writing, group task, project work etc. There is no wrong or right in this selection of tools. Instructor identifies variety of selected tools for the course to evaluate the students' performance and mention the evaluation tools in the course outline.
- **Evaluation policy and Grading** is about the institutional policy of examination and grading system. Policies also include the law of being absent in an exam,

course retake, course withdrawal, incomplete grade, individual or group work standard, field trip design, project work formation etc. Grading system shows the range of marks for different grades, and the calculation methods of course grade, semester grade and program grade points.

2.4.4 Step-4 Resources

This step includes the components a. Text book and reference, and b. Other resources.

- **Text book and reference** includes the names of one or more text books that will cover all of the topics selected for the course. Some more reference books are also to be mentioned here for student's learning support and extra knowledge for the course.
- **Other resources** are the list of all other resources that the students need to follow during the semester/trimester. These resources can be professional journal, research article, company report, conference proceedings, website, video/audio clip, or any other online resources.
- **Mapping of CLO with PO** Through another article in this series it is described that every program has a set of program outcomes (PO) that is expected to be achieved by all students during the study time-period of the program. These are achieved by course learning outcomes (CLO) tangled in different courses. A certain course may have 3 or 4 CLO's set by the course instructor according to the total plan of the outcome based education practiced in the institution. Each CLO is identified as one certain level of achievement in accordance with the three domains of Bloom's Taxonomy.

2.5 Activity-based learning

In an OBE environment, the role of the teacher is that of an engineer who designs an environment for learning. Here the pupil is actively involved in the learning process for the attainment of the intended learning outcomes. Henceforth, for designing an effective environment for learning a sound knowledge of activity-based learning strategies are essential.

Few strategies based on Activity Based Learning: MOOC, Flipped Classroom, Supervised Learning, Think Pair Share, Think Pair Solo, Round Robin, Collaborative Learning, Puzzles, Programmed Instructions, Matrix Method, Peer Learning, Work-Based Learning, Problem-Based Learning, Personalized Learning, Group Discussion, Debate, Case Studies, Fishbowl, Reciprocal Teaching, etc.

3 OBE Assessment

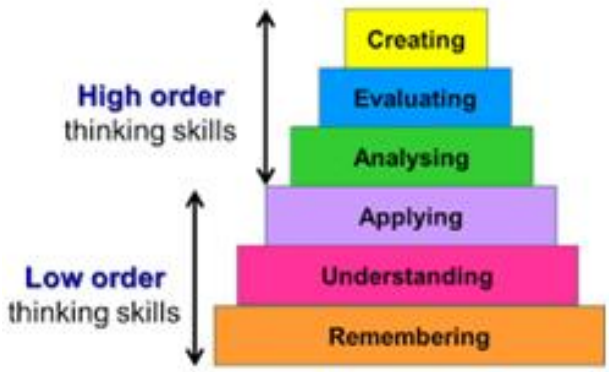
Outcome-based assessment (OBA) asks us to first identify what it is we expect students to be able to do once they have completed a course or program. It then asks us to provide evidence that they are able to do so. In other words, how will each learning outcome be assessed? What evidence of student learning is most relevant for each learning outcome and what standard or criteria will be used to evaluate that evidence? Assessment is therefore a key part of outcome-based education and used to determine whether or not a qualification has been achieved.

3.1 Revised Bloom's Taxanomy

Teachers need to make a learning plan for the students so that they can achieve the expected outcomes under all **three learning domains: Cognitive, Psychomotor and Affective.** After attaining the OBE every student shall be evaluated with their performance in different domains by various levels. The revised Revised Bloom's Taxanomy is shown in figure 3.1.

Teachers prepare the course outline and lesson plans in a pre-defined way so that, after the teaching-learning activities, students' performances are possible to measure according to the levels of learning domains. The levels of accomplishment in different domains may not be same. But, as per OBE, every student needs to achieve a satisfactory level in every learning domain. For example, it is not accepted that a student accomplishes highest level in Cognitive but failed to achieve a satisfactory level in Psychomotor or Affective. In such cases, the student needs to retake the course or continue learning the same towards achieving satisfactory levels in all learning domains.

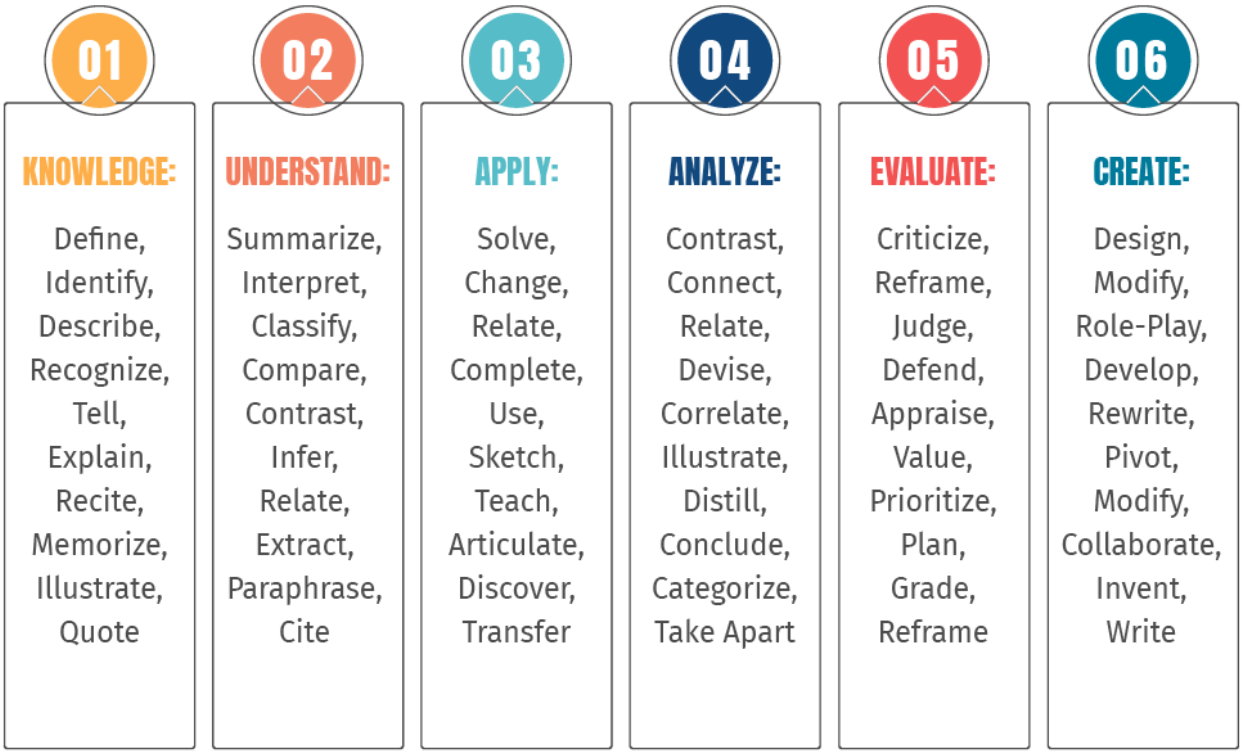
Figure 3.1 Revised Bloom's Taxanomy



3.1.1 Action Verbs and Assessments

Action verbs as in the figure 3.2 plays a vital role in constructing assessment questions. Action verbs are indicators of the complexity (level) of the question. Taxonomy of measurable verbs corresponding to each of the Bloom's cognitive levels. Describe and classify observable knowledge, skills and abilities. Frame the examination or assignment questions that are appropriate to the level we are trying to assess

Figure 3.2 Action Verbs



1. REMEMBER

Skill Demonstrated	Question Ques / Verbs for tests
• Ability to recall of information like, facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, describe, state, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.

2. UNDERSTAND

Skill Demonstrated	Question Ques / Verbs for tests
• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss

3. APPLY

Skill Demonstrated	Question Ques / Verbs for tests
• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills or knowledge • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify

4. ANALYZE

Skill Demonstrated	Question Ques / Verbs for tests
• break down a complex problem into parts. • Identify the relationships and interaction between the different parts of complex problem	classify, outline, break down, categorize, analyse, diagram, illustrate, infer, select

5. EVALUATE

Skill Demonstrated	Question Ques / Verbs for tests
• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate

6. CREATE

Skill Demonstrated	Question Ques / Verbs for tests
• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

3.1.2 Assessment Planning

First three learning levels- remember, understand and apply - some extent fourth level analyse - are assessed in the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) - limited amount of time.

Analysis, evaluation and creation can be assessed in extended course works or in a variety of student works like course projects, mini/ minor projects, internship experience and final year projects. Study the present pattern of assessment in each of the course in the program to gain insight about

a) Alignment of assessment questions with course learning outcomes

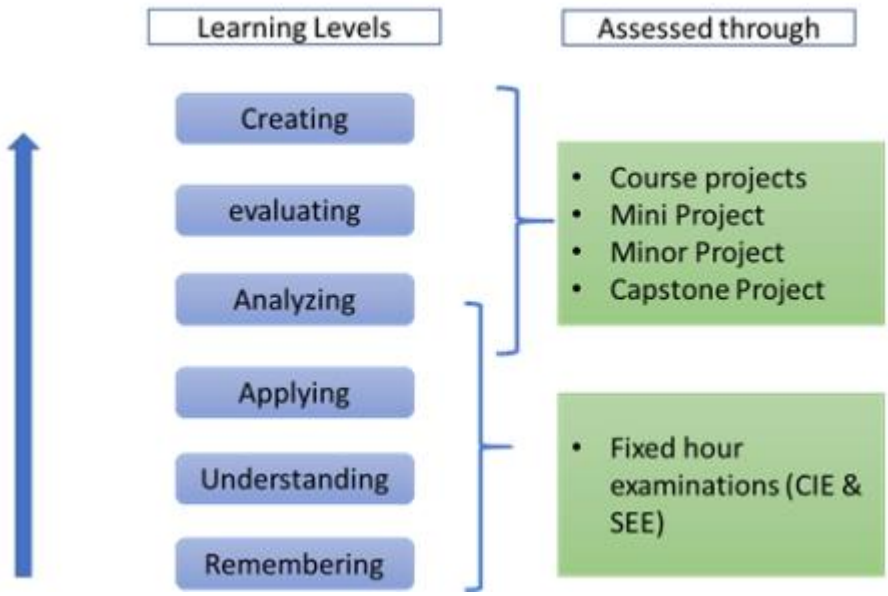
b) Whether all the learning outcomes are tested; sometimes some learning outcomes are over tested at the expense of others which may be not tested at all.

c) Overall weightage in the assessment, to each of Bloom's learning levels

d) Assessment methods used to adequately assess the content and desired learning outcomes

The Assessment Methods of Bloom's Levels is given belw in figure 3.3

Figure 3.3 Assessment Methods of Bloom's Levels



Based on the study, improvement priorities for each of the above factors need to be arrived at. The reform process needs to be well planned and implemented through institutional strategy and communicated to all stakeholders particularly to the students. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. **No more than 40% weightage for knowledge-oriented** questions. Bloom's taxonomy framework helps

the faculty to set examination papers that are well balanced, testing the different cognitive skills.

3.2 Mapping Program Outcomes to Assessment

Program Outcomes (POs) that reflect the skills, knowledge and abilities of graduates. Outcome-based education is a "design down" process. Moves from POs to Course Outcomes (COs) and outcomes for individual learning experiences. Teaching strategies, learning activities, assessments and resources should all be designed and organized to help students achieve the learning outcomes at the course level. For the effectiveness of the program, the achievement of POs is crucial which needs to be proven through accurate and reliable assessments.

3.2.1 Two-step Process for Bringing Clarity to POs

POs give useful guidance at the program level for the curriculum design, delivery and assessment of student learning. To bring more clarity into mapping of assessment questions directly to the POs two additional intermediatary components are introduced namely Compentencies and Performance Indicator as shown in figure 3.4.

3.2.2 Identify Competencies to be attained

For each PO define competencies – different abilities implied by program outcome statement that would generally require different assessment measures. They serve as an intermediate step to the creation of measurable indicators.

Example: Program Outcome (Attribute 3)

Design: PO3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Competencies

1. Demonstrate an ability to define a complex, open-ended problem in engineering terms.
2. Demonstrate an ability to generate a diverse set of alternative design solutions.
3. Demonstrate an ability to select the optimal design scheme for further development.
4. Demonstrate an ability to advance an engineering design to the defined end state

3.2.3 Define Performance Indicators

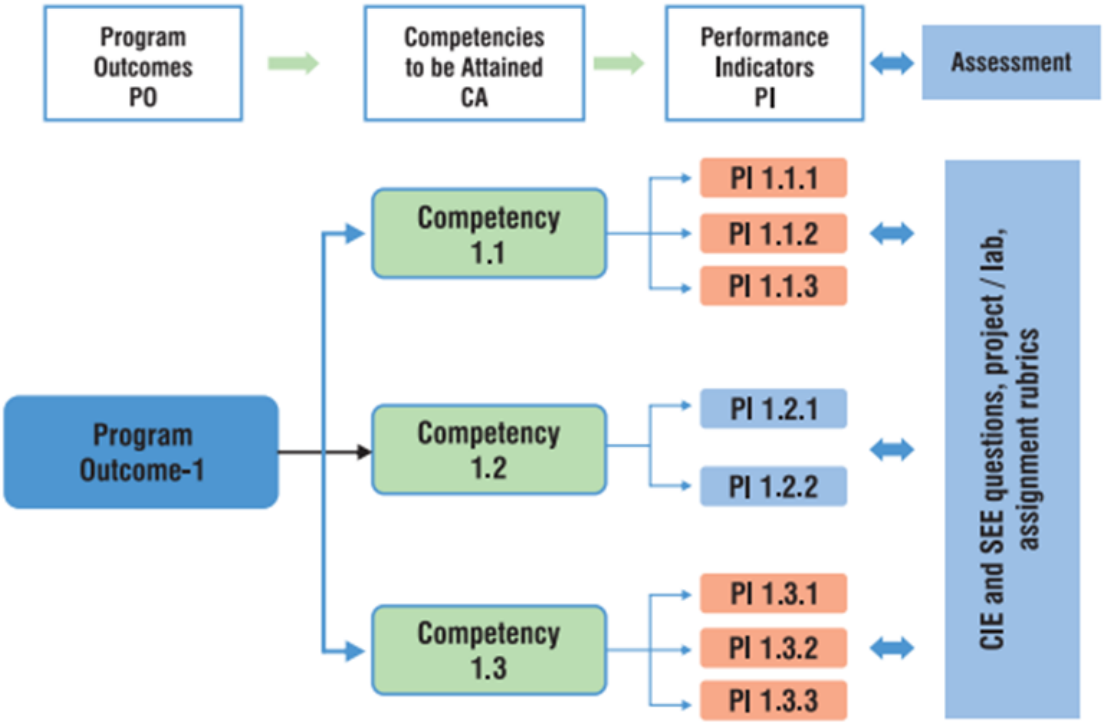
For each of the competencies identified, define performance Indicators (PIs) that are explicit statements of expectations of the student learning is shown in figure 3.4. They can act as measuring tools in assessment to understand the extent of attainment of outcomes. They can also be designed to determine the appropriate achievement level or competency of each indicator so that instructors can target and students can achieve the acceptable level of proficiency.

Example: For the Competency -2

Demonstrate an ability to generate a diverse set of alternative design solutions Performance Indicators:

1. Apply formal idea generation tools to develop multiple engineering design solutions
2. Build models, prototypes, algorithms to develop a diverse set of design solutions
3. Identify the functional and non-functional criteria for evaluation of alternate design solutions.

Figure 3.4 Mapping of CA and PI



PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.			
Competency		**Indicators**	
1.2	Demonstrate competence in mathematical modelling	1.2.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems
		1.2.2	Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
1.5	Demonstrate competence in basic sciences	1.5.1	Apply laws of natural science to an engineering problem
1.6	Demonstrate competence in engineering fundamentals	1.6.1	Apply engineering fundamentals
1.7	Demonstrate competence in specialized engineering knowledge to the program	1.7.1	Apply theory and principles of computer science and engineering to solve an engineering problem

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.			
Competency		**Indicators**	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.5.1	Evaluate problem statements and identifies objectives
		2.5.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem
		2.5.3	Identify mathematical algorithmic knowledge that applies to a given problem
2.6	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.6.1	Reframe the computer-based system into interconnected subsystems
		2.6.2	Identify functionalities and computing resources.
		2.6.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
		2.6.4	Compare and contrast alternative solution/methods to select the best methods
		2.6.5	Compare and contrast alternative solution processes to select the best process.
2.7	Demonstrate an ability to formulate and interpret a model	2.7.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
		2.7.2	Identify design constraints for required performance criteria.
2.8	Demonstrate an ability to execute a solution process and analyze results	2.8.1	Applies engineering mathematics to implement the solution.
		2.8.2	Analyze and interpret the results using contemporary tools.
		2.8.3	Identify the limitations of the solution and sources/causes.
		2.8.4	Arrive at conclusions with respect to the objectives.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.			
Competency		**Indicators**	
3.5	Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.5.1	Able to define a precise problem statement with objectives and scope.
		3.5.2	Able to identify and document system requirements from stake- holders.
		3.5.3	Able to review state-of-the-art literature to synthesize system requirements.
		3.5.4	Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard.
		3.5.5	Explore and synthesize system requirements from larger social and professional concerns.
		3.5.6	Able to develop software requirement specifications (SRS).
3.6	Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.1	Able to explore design alternatives.
		3.6.2	Able to produce a variety of potential design solutions suited to meet functional requirements.
		3.6.3	Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.7	Demonstrate an ability to select optimal design scheme for further development	3.7.1	Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
		3.7.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.8	Demonstrate an ability to advance an engineering design to defined end state	3.8.1	Able to refine architecture design into a detailed design within the existing constraints.
		3.8.2	Able to implement and integrate the modules.
		3.8.3	Able to verify the functionalities and validate the design.

3.2.4 Example Question Paper

Q. No	Question	Marks	BL	CO	PO	PI Code
	Section-A					
1.	a. What is an algorithm? Explain the characteristics of an algorithm.	2+6	1,2	2	1	1.4.1
	b. Write an algorithm to find angle between hour and minute hands of a clock at a given time.	7	3	3	1	1.4.1
	c. Is it mandatory to declare main() function with return type as void or int. What will be the effect if there is no return type declared for main() function?	3+2	4	3	1	1.4.1
	OR					
2.	a. What is the difference between definition and declaration in C? When a user writes "int x;" is it treated as declaration or definition in C.	3+2	2,4	3	1	1.4.1
	b. Write a program in C to find largest of 3 positive integer numbers using conditional operators.	7	3	3	1,2	1.4.1, 2.2.4
	c. What is meant by iterative statements? What are the different types of iterative statements in C?	8	1,2	3	1	1.4.1
	Section-B					

The sample template of the Question paper can downloaded from http://hit.edu.in/cse/OBE-QP.docx

3.3 ASSESSING HIGHER-ORDER ABILITIES & PROFESSIONAL SKILLS

Professional skills (also known as soft skills, generic skills or transferable skills) have emerged as important attributes of a graduate engineer, that deals with these attributes

(1) Communication

(2) Understanding ethics and professionalism

(3) Understanding global and societal contexts

(4) Lifelong learning

(5) Knowledge of contemporary issues.

Main obstacles in addressing these outcomes is the limitation of educational experience within our engineering programs. Coursework in our programs are oriented towards teaching technical knowledge and skills; hence, the assessment is limited to those abilities. To address these challenges, comprehensive reforms are needed in the way we design our curriculum, student learning experiences and assessment of the outcomes.

- Course projects
- Open-ended experiments in laboratories
- Project-based learning modules
- MOOCs (Massive Open Online Course)
- Co-Curricular experiences
- Mini / Minor projects
- Final year projects
- Internship experiences
- E-portfolios (Electronic portfolios) of student works

3.4 Using Rubrics as Assessment Tool

To evaluate, student works for attainment of course outcomes. POs, to have reliable methods / proper assessment tools. Rubrics provide a powerful tool for assessment and grading of student work. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students (and to other markers) your expectations in the assessment, and what you consider important.

There are three components within rubrics namely

(i) criteria / performance Indicator: the aspects of performance that will be assessed

(ii) descriptors: characteristics that are associated with each dimension

(iii) scale/level of performance: a rating scale that defines students' level of mastery within each criterion

RUBRICS FOR ASSESSMENT OF DESIGN PROJECTS

Category	Needs Improvements	Acceptable	Proficient
Purpose of the Project	Does not clearly explain the intended outcome of the project or provides little information about the problem that was being solved, the need being met, or why the project was selected	Provides a description of the intended outcome of the project which includes information about the problem that was being solved or the need being met, and why the project was selected	Provides a detailed intended outcome of the project which includes information about the problem that was being solved or the need being met, and clearly articulates the reasons and decision-making process used to select the project
Research	Lacks awareness of similar work done by others in an unacceptable literary form	Reflects awareness of similar work done by others and presents it in an acceptable literary format	•Reflects thorough understanding of similar work done by others and presents it in an acceptable literary format
Choices	Lacks justification of choices with little or no references to functional, aesthetic, social, economic, or environmental considerations	Justifies choices made with reference to functional, aesthetic, social, economic, or environmental considerations	Demonstrates sophisticated justification of choices with reference to functional, aesthetic, social, economic, or environmental consideration
Alternative Designs	Only one design presented or clearly infeasible alternative given. Serious deficiencies in exploring and identifying alternative designs.	Alternative approaches identified to some degree.	Final design achieved after review of reasonable alternatives.
Application of Engineering Principles	No or erroneous application of engineering principles yielding unreasonable solution. Serious deficiencies in proper selection and use of engineering principles.	Effective application of engineering principles resulting in reasonable solution.	Critical selection and application of engineering principles ensuring reasonable results.
Final Design	Not capable of achieving desired objectives.	Design meets desired objectives.	Design meets or exceeds desired objectives.
Interpretation of Results	No or erroneous conclusions based on achieved results. Serious deficiencies in support for stated conclusions.	Sound conclusions reached based on achieved results.	Insightful, supported conclusions and recommendations.

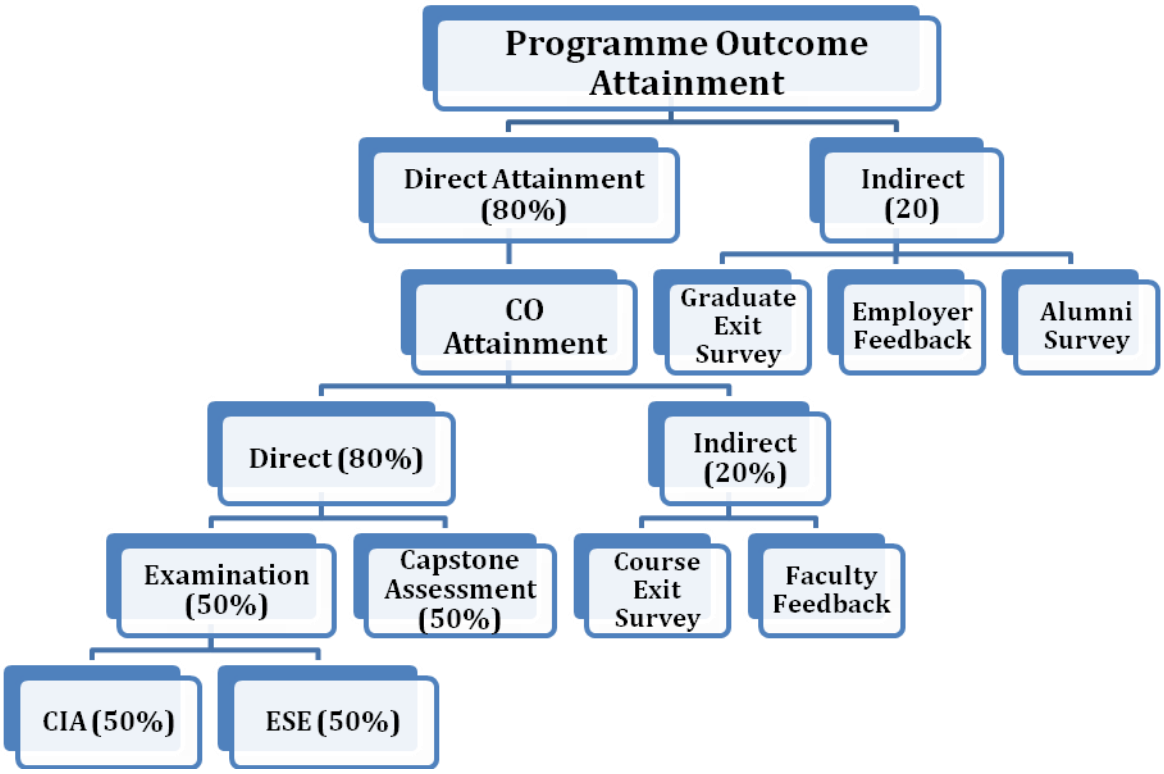
RUBRICS FOR ASSESSMENT OF LABORATORY

Experiment Component	Grading Rubrics			
	Excellent (5 Marks)	Good (4 Marks)	Satisfactory (3 Marks)	Inadequate (1-2 Marks)
Preparing Software Requirement Analysis (SRS) for the Scenario /Problem Statement **(5 Marks)**	Describe the purpose, scope of this document, and intended audience of this document. Provide a sufficient level of detail for designers to design a system satisfying these requirements and testers to verify that the system satisfies requirements. Identify the client, stakeholders, and intended users of your system. Provide a complete description of the real world problem being solved.	Sufficient background level of detail for designers to design a system satisfying these requirements and testers to verify that the system satisfies requirements and identify the client, stakeholders, and intended users of your system	Students are able to identifies the design system and basic requirements	Students are unable to explain the scope properly and level of detail for designers to design a system satisfying these requirements
Object Oriented Concept **(5 Marks)**	Identifies all of the object-oriented design elements and their relations Illustrate the relationships between a set of classes, interfaces and collaborations. Class diagrams demonstrate the static design view of a system	Identifies most of the object-oriented design elements and their relations	Identifies some of the object-oriented design elements and their relations	Identifies very few of the object-oriented design elements and their relations
Designing Standard UML Diagrams using Agro UML 2.0 or Rational Rose Suit. **(5 Marks)**	Appropriate notations are used for all design elements and Provides a great understanding of the Tool functionality	The use of UML tool is appropriate but lack of efficiency in the design and appropriate notations are used for most of the design elements	The use of UML tool is mostly appropriate but lack of efficiency in the design and appropriate notations are used for some of the design elements	The use of UML tool is inappropriate and lack of efficiency in the design and Lack of design element and in many cases inappropriate notations are used

4 OBE Attainment Process

The success of the OBE process is in setting up goals in terms of attainment at course levels and programme level. The attainment is an indicator of what is achieved through the programme and improve the process if any shortfall is observed and rise the goal if it consistently achievable. The various components of CO/PO attainments is shown in figure 4.1.

Figure 4.1 Components of CO/PO attainments



OBE attainment is calculated through bottom-up approach as in figure 4. The collective course outcome attainments of all courses in the curriculum alongwith the perception of the stakeholders contributes to the overall programme outcome attainment. The course outcome attainment of a given course is calculated using the performance in the assessments and surveys from students and faculty at course level. In summary,

- The attainment of COs correlates to the attainment of POs & PSOs.
- The program outcomes and program specific outcomes are achieved through a curriculum that offers a number of courses.

- The final attainment levels of POs and PSOs for a batch of students of a branch in all four years indicate the effectiveness of the program implemented.
- Each question in mid-semester examination, semester end examination, assignment and quiz are tagged to a specific CO.
- The attainment of each CO is computed as percentage of students above a target level set as the class average mark in that specific question. The overall CO attainment of CIA and ESE are separately computed as the average of all attainments of all contributions from all questions in CIA and ESE separately.

4.1 CO-PO Attainment

The attainment levels for CO and PO is set in consulatation with the stakeholders including academic experts, industry members, Alumni and department faculty members

4.1.1 CO Attainment Calculation

As mentioned above the CO attainment is calculated based on the direct and indirect assessement methods where the direct assessment contributes to 80% of attainment and 20% is allotted to the indirected method.

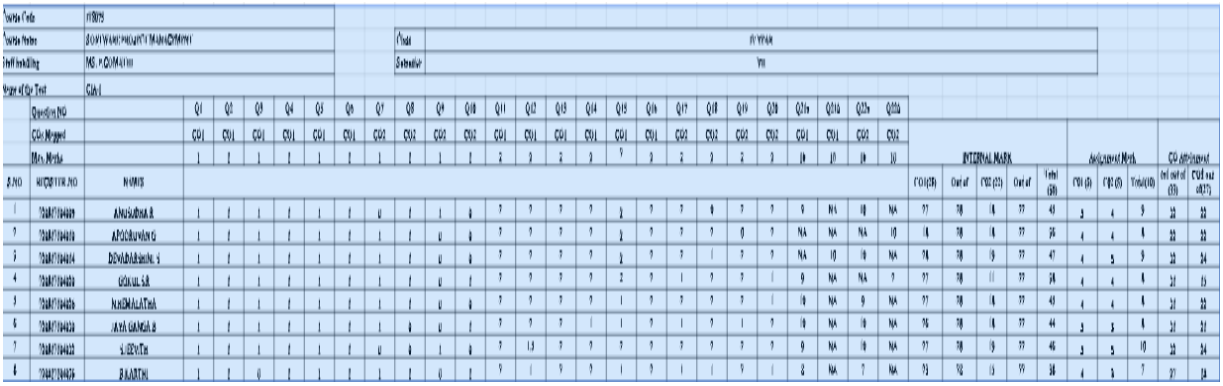
The target levels for the CO based on direct assessment is set as below;

Level 1 – 65% of students score more than 65% of marks in internal and external assessments

Level 2 – 70% of students score more than 65% of marks in internal and external assessments

Level 3 – 75% os students score more than 65% of marks in internal and external assessments

Calculations of CO attainment for each subject for each assessment is mapped as per the template given below and template is available at **http://hit.edu.in/cse/co-attainment.xlsx**



The indirect assessment for the CO attainment is obtained by collecting feedbacks for the students and faculty member of the course in the form of

- Course Exit Survey
- Faculty Feedback

4.1.2 Questionaries' for students on Course Exit Survey

1. Presented the course in a well organised manner
2. Stimulated interest in the course
3. Explained the course content clearly
4. Asked questions to promote interaction and reflective thinking
5. Used appropriate content delivery modes
6. Clarified all the doubts
7. Offers compliments for creativity
8. Engaged the class regularly and maintained discipline
9. Returned the valued answer scripts promptly providing feedback on the performance
10. Covered the entire syllabus at appropriate pace
11. The course is relevant to the programme of study
12. The course contents are sufficient
13. The recommended text and reference books are useful
14. The course outcome assessment methods are appropriate
15. <Course Outcome 1 specific Question>
16. <Course Outcome 2 specific Question>
17. <Course Outcome 3 specific Question>
18. <Course Outcome 4 specific Question>

19. <Course Outcome 5 specific Question>

4.1.3 Questionnaires' for Faculty towards Feedback on Course Exit Survey

1. The allocation of the credits to the course is appropriate
2. The depth of the course content is adequate to have significant learning outcomes
3. Syllabus is sufficient to bridge the gap between industry standards/current global scenarios and academics
4. The timely coverage of syllabus is possible in the mentioned number of hours
5. The units/sections in the syllabus are properly sequenced
6. This course structure meets the Course outcomes
7. The designed experiments stimulate the interest of students in the subject and deepen their understanding through relating theory to practice(Experiential learning
8. The practical's enable to develop experimental, design, problem solving and analysis skills of the students
9. Recommendations for course improvement (Please specify topics that should be added/dropped from the course, new books to be recommended, changes in teaching scheme and experiments, etc. if any)

Based on the survey, the corresponding CO attainment is calculated as per the template below;

course exit survey

CORSE OUTCOME ASSESSMENT 2017-2021 BATCH

Course Code		IT8075	Class	IV YEAR	
Course Name		SOFTWARE PROJECT MANAGEMENT	Semester	VII	
Staff handling		MS. P.GOMATHI			
CO Attainment		3			

S.NO	REGISTER .NO	NAMES	CO1 Attainment	CO2 Attainment	CO3 Attainment	CO4 Attainment	CO5 Attainment	CO6 Attainment
3	720817104014	DEVADARSHINI. S	5	4	3	3	5	5
4	720817104020	GOKUL.S.R	4	5	4	5	3	4
5	720817104026	N.HEMALATHA	5	4	3	2	4	3
6	720817104030	JAYA GANGA B	3	4	3	5	3	3
7	720817104032	S.JEEVITH	3	4	3	5	4	3
8	720817104036	B.KARTHI	4	5	4	4	3	3

4.2 CO-PO Mapping

The course articulation matrix as shown below provides the mapping of a course COs to overall Programme Outcome. Course articulation matrix is attached with the syllabus as well the Course Information developed by the faculty member.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	2	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	2	1	1	3	-	-	-	-	-	-	-	1	2	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	2	3	-

To measure PO in direct method a CO/PO matrix is used to measure PO. The CO are linked to the PO using the CO vs PO matrix as stated in Course Syllabus blueprint as given above. When designing the CO, lecturers of each course map their CO to the appropriate PO to ensure that all PO are delivered throughout the study.

The PO attainment is calculated by using the predefined CO/PO matrix and the value of Final CO attainment for the subject. A three scale attainment is used for measuring the PO attainment. The PO attainment is calculated by using the formula

- PO attainment = Avg, of CO's of a PO /3 X Final CO attainment for the subject

The attainment level for the Regulations 2021 is set 65 % for all POs.

The course attainment through direct method is calculated by mapping all the COs of all course towards the POs and PSOs are given below and the sample template is given at http://hit.edu.in/cse/co-po-mapping-r2017.pdf

PO ATTAINMENT THROUGH DIRECT METHOD

COURSE CODE	COURSE CODE	CO Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C101	C101	2.8								0.933333333		2.8		2.333333333			2.8
C102	C102	2	2.8	0.933333333	0.933333333						0.933333333				0.933333333		
C103	C103	2.25	2.8	0.933333333	0.933333333						0.933333333				0.933333333		
C104	C104	1.8	2.8	0.933333333	0.933333333										0.933333333		
C105	C105	1.95	2.8	1.866666667	1.866666667										2.8	1.866666667	
C106	C106	1															
C107	C107	1.2															

4.2.1 PO Indirect Attainment

The perception of stakeholders are considered as part of the indirect assessment of PO and PSO attainment to a quantum of 20% towards overall calcuation. Following are surveys and feedback collected

- Alumni Survey
- Graduate Exit Survey
- Parent Survey
- Employer Survey

  The sample PO attainment template os provided at **http://hit.edu.in/cse/po-attainment.xlsx**

4.2.1.1 Questionaries for Employer Survey

1. How well our graduates apply knowledge of mathematics, basic science and engineering in their profession?
2. How well our graduates analyze and develop solutions to computational problems?
3. How well our graduates design, implement and evaluate a computational system to meet desired needs within realistic constraints?
4. How well our graduates apply design and development principles in the construction of software systems of varying complexity and perform testing?
5. How well our graduates Use appropriate techniques, resources and Modern Tools to solve complex problems?
6. How well our graduates develop innovative ideas that can be translated into products?
7. How well our graduates understand the impact of Engineering practice in Environment context and need for sustainable development?
8. How well our graduates Understand professional and ethical responsibilities as an engineer (e.g. safety, professional ethics, code of conduct)?
9. How well our graduates function effectively as a member or leader in teams (Teamwork)?
10. How well our graduates Communicate effectively by writing reports, designing documentation and making presentations?
11. How well our graduates understand the Principles of management and Finance to develop a software project?
12. How well our graduates Aware of the need for, and improved ability to engage in life-long learning (seeking further education, self-learning, membership in professional societies)?

13. How well our graduates imparted professional skills in the 4 years of course duration?
14. How well our graduates are performing to become a successful software engineer?
15. How well our graduates Communication and leadership skills help them to be a better team leader or member?

4.2.1.2 Questionaries for Alumni Survey

1. How well you are applying the knowledge of mathematics, Science and Engineering applicable to CSE discipline.
2. How well you are analyzing and developing solutions to computational problems using appropriate algorithms.
3. How well you are designing, implementing and evaluating a computational system to meet desired needs of the society.
4. How good are you applying design and development principles in the construction of software systems of varying complexity and perform testing.
5. How extent you are utilizing appropriate techniques, skills, and modern tools to produce quality software products and solutions using Software Engineering principles.
6. To what degree your innovative ideas are translated into products benefiting the society and the economic growth.
7. How far you can assess the impact of engineering practices on societal and environmental sustainability.
8. How far you have understood and applied professional, ethical, security, social issues and responsibilities for the computing profession
9. How efficient are you a good team player and a team leader.
10. How effectively you can communicate, write effective reports, design documentation and make effective presentations.
11. To what extent you are better in managing resources for successful completion of projects
12. To what extent you can recognize the need and an ability to engage in life-long learning.
13. How effective are you in understanding and analyzing the real world computational problems and to develop solutions by applying mathematical logic, appropriate data structures and algorithms.
14. How far you rate yourself in becoming a successful software engineer by creating and using modern IT tools.
15. How effective is your communication and leadership skills to endure yourselves working as a member or managing a team.

16. Any other improvements, suggestions would you like to share to improve teaching learning process

4.2.1.3 Questionaries for Graduate Exit Survey

1. According to you how well the department focused on imparting the ability to apply knowledge of mathematics, Science and Engineering applicable to CSE discipline.
2. According to you how well the department made you to analyze and develop solutions to computational problems using appropriate algorithms.
3. How well the department equipped you to design, implement and evaluate a computational system to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability and sustainability.
4. How good you can able to apply design and development principles in the construction of software systems of varying complexity and perform testing.
5. How well you are equipped to use appropriate techniques, skills, and modern tools to produce quality software products and solutions using Software Engineering principles.
6. How well the department focused on imparting the ability to develop innovative ideas that can be translated into products benefiting the society and the economic growth.
7. How good you can assess the impact of engineering practices on societal and environmental sustainability.
8. How well you understood and you can pply professional, ethical, security, social issues and responsibilities for the computing profession
9. Rate your effectiveness as individuals and as a member of a team to share computing design, assessment or implementation of a common goal.
10. How well you can communicate, write effective reports, design documentation and make effective presentations.
11. How well the department has imparted good engineering and managerial skills for successful completion of projects
12. How consistent the department insists and recognizes the need and an ability to engage in life-long learning.
13. How well the department imparted professional skills to understand and analyze the real world computational problems and to develop solutions by applying mathematical logic, appropriate data structures and algorithms.
14. How confident are you to become a successful software engineer by creating and using modern IT tools.
15. How well the department incorporate skills such that Graduate will have communication and leadership skills to endure themselves working as a member or managing a team.

16. Any other comments:

4.2.1.4 Questionaries for Parent Survey

1. Are you satisfied with the academic performance of your ward at HITECH?
2. Do you think that the knowledge level of your ward is improved?
3. Did your ward achieve your expectations level in his career?
4. Are you satisfied with the employment status of your ward?
5. Do you observed Improvement in soft skills, knowledge, ethics, morality in your ward while studying in college.
6. Is your ward's leadership quality enhanced?
7. What do you feel about the social behavior of your ward after joining HITECH?

The feedbacks on the above surveys are analyzed and indirect attainment to the PO is calculated as per the following template

CONSOLIDATED ALUMNI FEEDBACK

Total Number of Feedbacks Received: 40

PO & PSO	No of Responses for "Excellent"	No of Responses for "GOOD"	No of Responses for "SATISFACTORY"	No of Responses for "FAIR"	No of Responses for "POOR"	PO Attainment
PO1	25	7	4	2	2	2.53
PO2	12	15	8	5	0	2.18
PO3	10	15	12	3	0	2.18
PO4	12	17	10	1	0	2.28
PO5	14	12	12	0	2	2.30

Finally attainment is calculated combining both the direct and indirect attainment calucations as per the template below

Method		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Direct Method		2.80	1.17	1.17	1.17	2.80	1.17	1.17	1.17	0.93	2.80	1.40	2.33
Indirect Method (0 % Exit Survey) + 25 % Alumni feedback + 25% Employer Feedback	Alumni Feedback	2.53	2.18	2.18	2.28	2.30	1.70	2.18	2.18	2.08	2.30	2.15	2.28
	Exit Survey	2.19	1.90	1.78	1.87	1.84	1.83	1.83	1.76	1.83	1.90	1.85	1.83
	Employer Feedback	2	2.08	2	2.08	1.6	1.44	1.72	1.68	1.36	1.56	1.32	1.4
	Consolidated	2.22	2.01	1.93	2.02	1.89	1.70	1.89	1.84	1.77	1.91	1.79	1.83
Overall PO Attainment (80 % Direct Method) + (20 % Indirect Method)		2.68	1.34	1.32	1.34	2.62	1.27	1.31	1.30	1.10	2.62	1.48	2.23
Target Level		1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Attained (Yes / No)		YES	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	YES

The attainment levels are compared with target levels and activites to enhance the POs attainment is further initiated. In case of consistent PO attainment over a period of 3 years the attainment levels are revised.