



Govt. Polytechnic , Jhajjar

**OUTCOME BASED EDUCATION (OBE)
MANUAL**

Preface

The purpose of this document is to provide technical assistance to the Faculty 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 – manual is available at the Institute's website.

Govt. Polytechnic Jhajjar

Govt. Polytechnic Jhajjar is situated on Jhajjar-Bahadurgarh road, about 4 kilometer from Jhajjar city. This Institute has an impressive campus spread over an area of 10 acres and is well connected to Bahadurgarh, Rohtak, Rewari, Gurgaon and New Delhi.

The Institute was established in the year 1962. Govt. Polytechnic Jhajjar is running three year diploma courses in Computer Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Electronics & Communication and Ceramic Technology . The respective laboratories and workshops for each course are well equipped with modern machinery.

The Institute offers following undergraduate programs of Three years (Six semesters) & two years (Four Semesters) duration.

Sr. No	Course	Intake
1	Ceramic Engineering	60
2	Civil Engineering	60
3	Computer Engineering	60
4	Electrical Engineering	60
5	Electronics & Communication Engineering	60
6	Mechanical Engineering	120
Total		420

This institute had a long history of producing technical manpower and rendering technical services to the society. Many students of this institute are chairing the topmost positions in Govt. offices and in many reputed companies. Some of the pass-out students also became successful entrepreneurs.

Govt. Polytechnic Jhajjar is approved by AICTE New Delhi and affiliated to Haryana State Board of Technical Education Panchkula.

OUTCOME-BASED EDUCATION (OBE)

Outcome based education (OBE) is student-centric instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes. Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behaviour a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation.

Outcome Based Education (OBE) is a method of curriculum design and teaching that focuses on what students can actually do after they are taught. OBE's instructional planning process is a reverse of that associated with TE (Traditional Education) planning. The desired outcome is selected first and the curriculum, instructional materials and assessments are created to support the intended outcome. All educational decisions are made based on how best to facilitate the desired outcomes.

Program Outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation.

OBJECTIVES OF OBE

- Enable Students to do more challenging tasks: write project proposals, complete projects, analyse case studies, give case presentations, show their abilities to think, question, research, and make decisions based on the findings.
- Enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitudes and values) or attributes a graduate of a programme should be capable of demonstrating on successful completion of the programme of study.
- Maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility.
- Provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

Why OBE?

- International recognition and global employment opportunities.
- More employable and innovative graduates with professional and soft skills, social responsibility and ethics.
- Better visibility and reputation of the technical institution among stakeholders.
- Improving the commitment and involvement of all the stakeholders.

- Enabling graduates to excel in their profession and accomplish greater heights in their careers.
- Preparing graduates for the leadership positions and challenging them and making them aware of the opportunities in the technology development.

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 help 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..

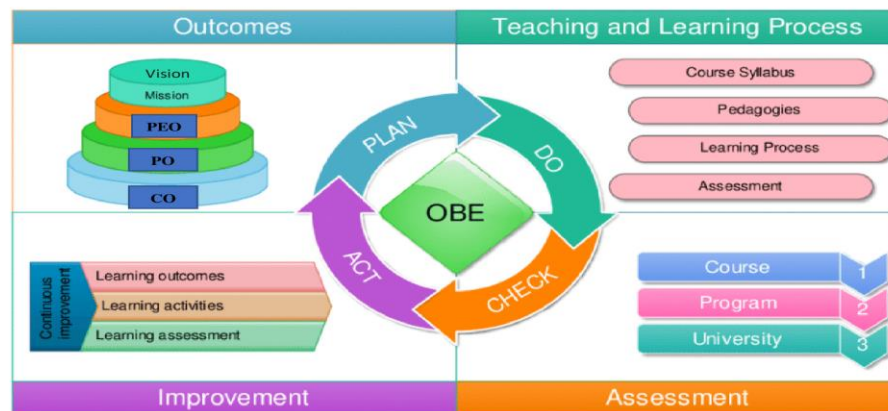


Figure 1. OBE Process

BENEFITS OF OBE

Clarity: The focus on outcome creates a clear expectation of what needs to be accomplished by the end of the course.

Flexibility: With a clear sense of what needs to be accomplished, instructors will be able to structure their lessons around the students' needs.

Comparison: OBE can be compared across the individual, class, batch, program and institute levels.

Involvement: Students are expected to do their own learning. Increased student involvement allows them to feel responsible for their own learning, and they should learn more through this individual learning.

BREIF ABOUT OBE AND ACCREDITATION

From 13th June 2014, India has become the permanent signatory member of the Washington Accord. Implementation of OBE in higher technical education also started in India. The National Assessment and Accreditation Council (NAAC) and National Board of Accreditation (NBA) are the autonomous bodies for promoting global quality standards for technical education in India. NBA has started accrediting only the programs running with OBE from 2013. The National Board of Accreditation mandates establishing a culture of outcome based education in institutions that offer Engineering, Pharmacy, Management program. Reports of outcome analysis help to find gaps and carryout continuous improvements in the education system of an Institute, which is very essential.

INSTITUTE VISION

To be a Center of Academic Excellence to provide Value based Technical Education

INSTITUTE MISSION

1. To achieve academic excellence through innovative learning practices to transform students into professionals.
2. To enhance employability & Entrepreneurial skills through Industry - Institution interaction.
3. To enhance skills of Human Resource through faculty development programs.
4. To strengthen Economical Weaker & Rural Youth through Technical Education.
5. To inculcate Moral , Ethical and Professional values for sustainable development.

Quality Policy of Institute

Govt. Polytechnic Jhajjar imparts value based Technical Education and Training to meet the requirements of Students, Industry, Trade / Profession, Various Sectors ,Research and Development Organizations for Self-sustained growth of Society.

PROGRAM OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.**

FRAMING COMMON POLICY FOR OBE IN INSTITUTE

Outcome-Based Education (OBE) is a student-centric learning model that helps teachers to plan the course delivery and assessment.

- Define Mission statements, Vision statements for the Institute and Department
- Define Program Educational Objectives
- Define Program Specific Outcomes
- Prepare lecture-wise Course Lesson Plan
- Define Course Outcomes with Bloom's Taxonomy for each course
- Map topics with Course outcomes
- Assignments, Quizzes, Content beyond syllabus coverage, Tests, course feedback etc.
- Define rubrics for Tutorial, Practical, seminar, Mini Project, Final year Project
- Measure the attainment of each CO through defined assessments tools.
- Track students performance
- Map courses with Program outcomes at suitable levels of Bloom's Taxonomy
- Identify Gaps in the Curriculum and adopt suitable measures to bridge the Gap
- Compare PO/PSO for last 3 academic years and propose remedial actions
- Assess the attainment of Program Educational Objectives

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

DRAFTING METHODOLOGY FOR IMPLEMENTATION OF OBE

Some important aspects of the Outcome Based Education:

Course is defined as a theory, practical or theory cum practical subject studied in a semester. For Example: Fundamental of ELeCtrical Engineering

Programme is defined as the specialization or discipline of a Diploma. It is the interconnected arrangement of courses, co-curricular and extracurricular activities to accomplish predetermined objectives leading to the awarding of a Diploma . For Example: Diploma in Electronics and Communication Engineering .

A few parameters that are required in order to measure Outcome-Based Education are:

Course Outcome (CO): COs are major domain specific outcomes written using action verbs which are specific, measurable and can be demonstrated by students on completion of the course. Course outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally six or more course outcomes may be specified for each course based on its weightage. Course outcomes are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester.

Program Educational Objectives (PEOs): The Programme Educational Objectives of a program are the statements that describe the expected achievements of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after graduation. PEOs should be consistent with the mission of the Institution. The PEO's should evolve through constant feedback from alumni, students, industry, management etc.

Programme Specific Outcomes (PSOs): Programme Specific Outcomes are what the students should be able to do at the time of graduation with reference to a specific discipline. Usually there are two to four PSOs for a programme.

Programme Outcomes(PO): Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the 07 Program Outcomes as described by NBA for under Diploma engineering programs.

Define PEO, PO, PSO and CO. This is the most important part of the Outcome-Based Education model. Course Outcomes (CO) are defined for all courses and Program Outcomes (PO)/Program Specific Outcomes (PSO) are measured for all programs in the institution. Course Outcome remains the base of the hierarchy of outcomes and is the tools that can be used to measure student performance in each course.

REVISED BLOOM'S TAXONOMY (RBT)

Bloom's taxonomy is considered as the global language for education. Bloom's Taxonomy is frequently used by teachers in writing the course outcomes as it provides a readymade structure and list of action verbs. A summary of Anderson and Krathwohl's revised version of Bloom's taxonomy of critical thinking is provided in below Figure 2:

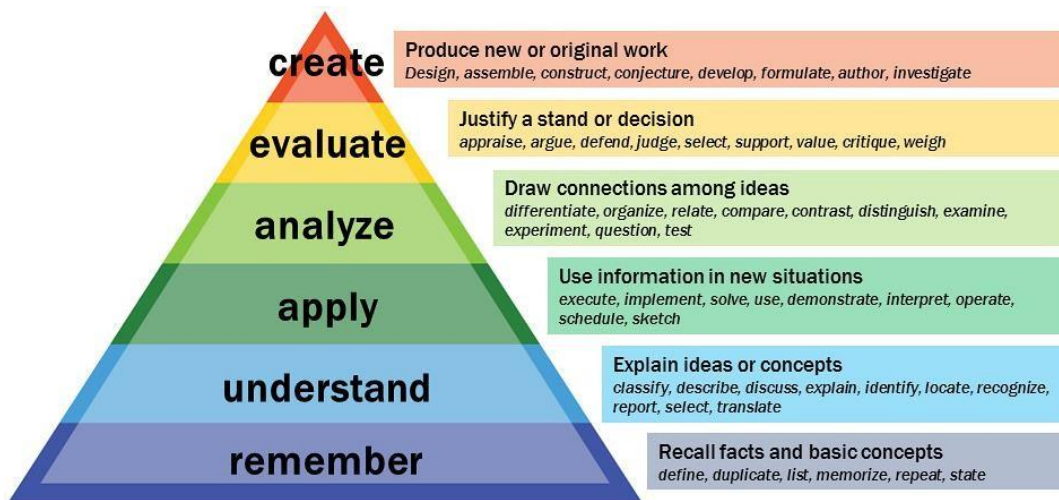


Figure 2 REVISED BLOOM'S TAXONOMY (RBT)

REVISED BLOOM'S TAXONOMY (RBT)

Definitions of the different levels of thinking skills in Bloom's taxonomy:

- 1. Remember:** Recalling relevant terminology, specific facts, or different procedures related to information and/or course topics. At this level, a student can remember something, but may not really understand it.
- 2. Understand:** The ability to grasp the meaning of information (facts, definitions, concepts, etc.) that has been presented.
- 3. Apply:** Being able to use previously learned information in different situations or in problem solving.
- 4. Analyze:** The ability to break information down into its component parts. Analysis also refers to the process of examining information in order to make conclusions regarding cause and effect, interpreting motives, making inferences, or finding evidence to support statements/arguments.
- 5. Evaluate:** Being able to judge the value of information and/or sources of information based on personal values or opinions.
- 6. Create:** The ability to creatively or uniquely apply prior knowledge and/or skills to produce new and original thoughts, ideas, processes, etc. At this level, students are involved in creating their own thoughts and ideas.

REVISED BLOOM'S TAXONOMY (BT)

The cognitive process dimensions-categories					
Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
L1: REMEMBER	L2: UNDERSTAND	L3: APPLY	L4: ANALYSE	L5: EVALUATE	L6: CREATE
<ul style="list-style-type: none"> • Recognizing (identifying) • Recalling (retrieving) 	<ul style="list-style-type: none"> • Interpreting • Illustrating • Classifying • Summarizing • Inferring (concluding) • Comparing • Explaining 	<ul style="list-style-type: none"> • Executing • Implementing 	<ul style="list-style-type: none"> • Differentiating • Organizing • Attributing 	<ul style="list-style-type: none"> • Checking (coordinating, detecting, testing, monitoring) • Critiquing (judging) 	<ul style="list-style-type: none"> • Planning • Generating • Producing (constructing)

The Knowledge Dimension			
Concrete Knowledge → Abstract knowledge			
FACTUAL	CONCEPTUAL	PROCEDURAL	METACOGNITIVE
<ul style="list-style-type: none"> • Knowledge of terminologies • Knowledge of specific details & elements 	<ul style="list-style-type: none"> • Knowledge of classifications and categories • Knowledge of principles & generalizations • Knowledge of theories, models & structures 	<ul style="list-style-type: none"> • Knowledge of subject specific skills and algorithms • Knowledge of subject specific techniques and methods • Knowledge of criteria for determining when to use appropriate procedures 	<ul style="list-style-type: none"> • Strategic Knowledge • Knowledge about cognitive task, including appropriate contextual and conditional Knowledge • Self- Knowledge

ACTION VERBS FOR COURSE OUTCOMES

List of Action Words Related to Critical Thinking Skills:

Here is a list of action words that can be used when creating the expected student learning outcomes related to critical thinking skills in a course. These terms are organized according to the different levels of higher-order thinking skills contained in Anderson and Krathwohl's (2001) revised version of Bloom's taxonomy.

Here is the revised Bloom's document with action verbs, which we frequently refer to while writing Course Outcomes (COs) for our courses.

Sample Action Verbs for Course Outcomes (COs):

S. No.	BLOOM'S LEVEL	COGNITIVE LEVEL	ACTION VERBS
Lower Order of Thinking (LOT)			
1	L1: REMEMBER	Knowledge	Arrange Cite Define Describe Duplicate Identify Label List Memorize Match Name Order Outline Pronounce Quote Recall Recite Recognize Record Repeat Reproduce State Tabulate
2	L2: UNDERSTAND	Comprehension	Alter Classify Compare Convert Defend

S. No.	BLOOM'S LEVEL	COGNITIVE LEVEL	ACTION VERBS
			Describe Discuss Estimate Explain Express Extend Generalized Give examples Indicate Interpret Locate Paraphrase Recognize Rephrase Restate Reword Rewrite Select Summarize Translate Write
3	L3: APPLY	Application	Acquire Apply Calculate Change Chart Choose Compute Demonstrate Discover Dramatize Draw Employ Illustrate Interpret Manipulate Modify Operate Practice Prepare Produce Schedule Show Sketch Solve Use

S. No.	BLOOM'S LEVEL	COGNITIVE LEVEL	ACTION VERBS
Higher Order of Thinking (HOT)			
4	L4: ANALYZE	Analysis	Analyze Appraise Ascertain Associate Breakdown Calculate Categorize Classify Compare Conclude Contrast Criticize Designate Determine Diagnose Diagram Differentiate Discriminate Distinguish Divide Examine Experiment Explain Explore Find Infer Investigate Outline Point out Question Reduce Relate Separate Specify Subdivide Test
5	L5: EVALUATE	Evaluation	Appraise Argue Assess Attach Choose Compare Conclude Criticize

S. No.	BLOOM'S LEVEL	COGNITIVE LEVEL	ACTION VERBS
			Critique Deduce Defend Estimate Evaluate Grade Judge Justify Measure Predict Prove Rate Recommend Reframe Review Support Test Value Weigh
6	L6: CREATE	Synthesis	Create Arrange Assemble Collect Combine Comply Compose Conceive Construct Create Derive Design Develop Devise Expand Extend Formulate Generalize Generate Integrate Invent Modify Organize Originate Plan Prepare Produce

S. No.	BLOOM'S LEVEL	COGNITIVE LEVEL	ACTION VERBS
			Project Rearrange Reconstruct Reorganize Revise Set up Synthesize

Illustration (use of action verb w.r.t knowledge dimension and order of thinking):

BLOOM'S LEVEL/ Use of Action Verbs	Factual	Conceptual	Procedural	Metacognitive
L1: REMEMBER	List properties of Soil.	Recognize characteristic of material.	Explain working of pump.	Identify strategies for report writing.
L2: UNDERSTAND	Summarize features of a new product.	Classify adhesives by toxicity.	Explain assembly instructions.	Predict the behaviour of member.
L3: APPLY	Respond to frequently asked questions.	Provide advice to team members.	Carry out pH tests of water samples.	Use modern techniques to get solution.
L4: ANALYSE	Explain the selection of tool/activity.	Differentiate Lower Order of Thinking (LOT) and Higher Order of Thinking (HOT).	Integrate compliance with regulations.	Assess the project work.
L5: EVALUATE	Select the appropriate tool.	Determine relevance of results.	Judge efficiency of sampling techniques.	Reflect on one's progress.
L6: CREATE	Generate a log of daily activities.	Assemble a team of experts.	Design efficient project workflow.	Create a learning portfolio.

GUIDELINES FOR WRITING COURSE OUTCOME STATEMENTS

Well-written course outcomes involve the following parts:

1. Action verb
2. Subject content
3. Level of achievement as per RBT Levels

Illustration:

Students are able to

- Design column splices and bases. → Action verb (underlined)
- Determine the losses in a flow system. → Subject content
- Use structural analysis software to a competent Level. → Level of achievement
- Present seminar on real life problems. → Modes of performing task with action verb (underlined)

While writing COs the following questions/points must be addressed properly

Table : A

Specific	Is there a description of precise behavior and the situation it will be performed in? Is it concrete, detailed, focused and defined?
Measurable	Can the performance of the outcome be observed and measured?
Achievable	With a reasonable amount of efforts and applications can the outcome be achieved? Are you attempting too much?
Relevant	Is the outcome important or worthwhile to the learner or stakeholder? Is it possible to achieve this outcome?
Time-Bound	Is there a time limit, rate, number, percentages or frequency clearly stated? When will this outcome be accomplished?

Note: If Laboratory is given as separate course (with course code) then there should be separate course outcome for Laboratory

PROCESS AT DEPARTMENT LEVEL TO MAINTAIN QUALITY OF CO

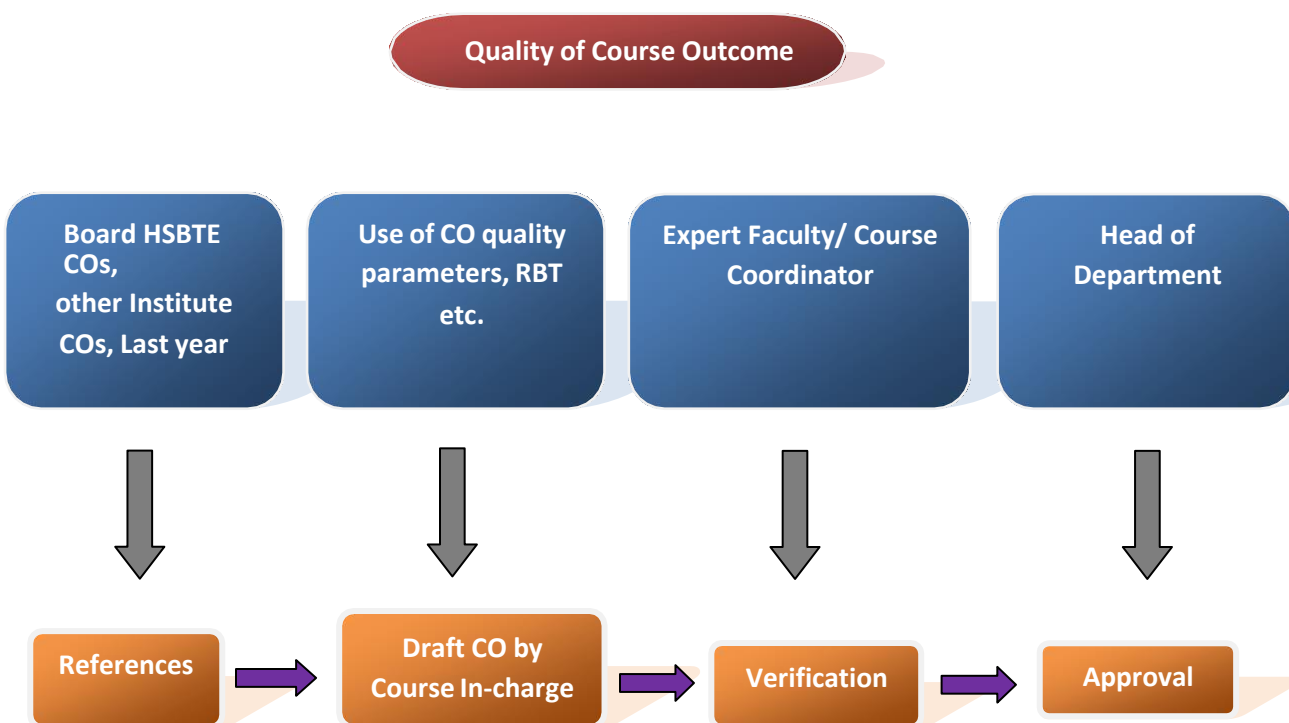


Fig: 2 Process to maintain quality at Departmental level

Table : B Guidelines/Checklist for COs:

Numbers of COs	4 to 6
CO essentials	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
Based on RBT	Understand, Remember, Apply, Analysis, Evaluate, Create
Number of RBT Considered in one course	Minimum 3 (Theory Courses up to level 1 to 5, Practical Courses and Project up to level 6)
Technical Content/point of curriculum	All curriculum contents are covered
Curriculum gap	Additional CO for gap identified/filling.

CO-PO Mapping Guidelines

KEY WORDS

Most of the times, appropriate keyword is sufficient for mapping.

Table : C

Level	Keywords used in writing COs
No. mapping (-)	Key words related with LOT and not related with course or any outcomes
Low (1)	Major parts is reflected through keywords/action verbs
Medium (2)	Major parts of PO is reflected through keywords/action verbs.+ moderate level performance is expected from students to achieve PO
High (3)	Exact action verb of PO + critical performance expected from student to achieve PO

Assessment tools are in place for computing Direct Attainment of Theory Courses, Laboratory Courses, Projects and Seminar Courses:

Theory Courses

- Class Tests
- Sesionals Tests
- Semester End Examination

Lab Courses

- Continuous monitoring in regular lab sessions (Lab Courses)
- Internal Lab Examination
- Lab Semester End Examination

Projects

- Mini Projects
- Major Project

Seminars

- Project Seminar
- Technical Seminar
- **Assessment tools used for Indirect Attainment:**
 - Course End Surveys

Every CO must be correlated with each PO and appropriate mapping may be selected.

Keywords

Level	Keywords Used in writing COs
No mapping (-)	Key words related with LOT and not related with course or any outcomes.
Low (1)	Part of PO is reflected through keywords/action verbs.
Medium (2)	Major part of PO is reflected through keywords/action verbs and moderate level performance is expected from student to achieve PO.
High (3)	Exact action verb of PO and critical performance expected from student to achieve PO.

Critical Assessment Record for PO

Level	Assessment Depth
No mapping (-)	No rubric used for assessment.
Low (1)	Single rubric category used for assessment.
Medium (2)	Two rubric category used for assessment.
High (3)	Three or more rubric category used for assessment.

Illustration:

Category No. 1 2 3	Rubric Category	Level of Performance			
		4	3	2	1
1	Group Leader	Seeks opportunities to lead; while leading is attentive to each member	Will take lead if group insists; not good at being attentive to each member.	Resists taking on leadership role; while leading allows uneven contributions.	Never shows Up.
2	Contribution	Always contributes; quality of contributions is exceptional.	Sometimes contributes; quality of contributions is fair.	Rarely contributes; contributions are often peripheral or irrelevant; frequently misses team sessions.	Never shows up and never contributes.
3	Cooperation	Always Cooperative with all members, support good initiatives.	Cooperative with members, but sometimes argue.	Cooperative with few members, and argue most of time.	Non cooperative.

Test Item:

- Class Tests
- Sessional Tests
- Semester End Examination

Assessment Items:

- Quizzes
- Assignment problems
- Simulation
- Laboratory experiments
- Project, field work and report presentation
- Tutorials, activities & etc.

Any other criteria with proper justifiable document is acceptable.

SETTING TARGETS FOR ATTAINMENT

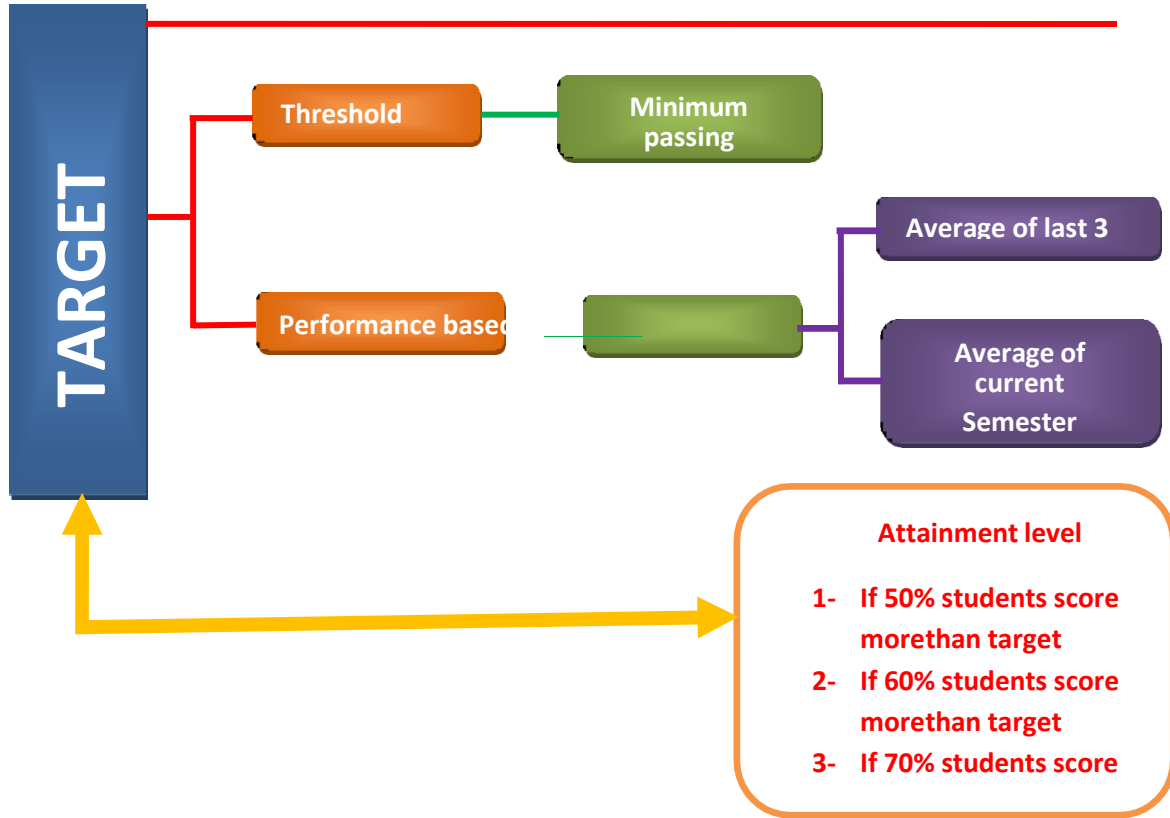


Fig: 3 Target setting for Attainment

Student Competency

Chart of Action plan

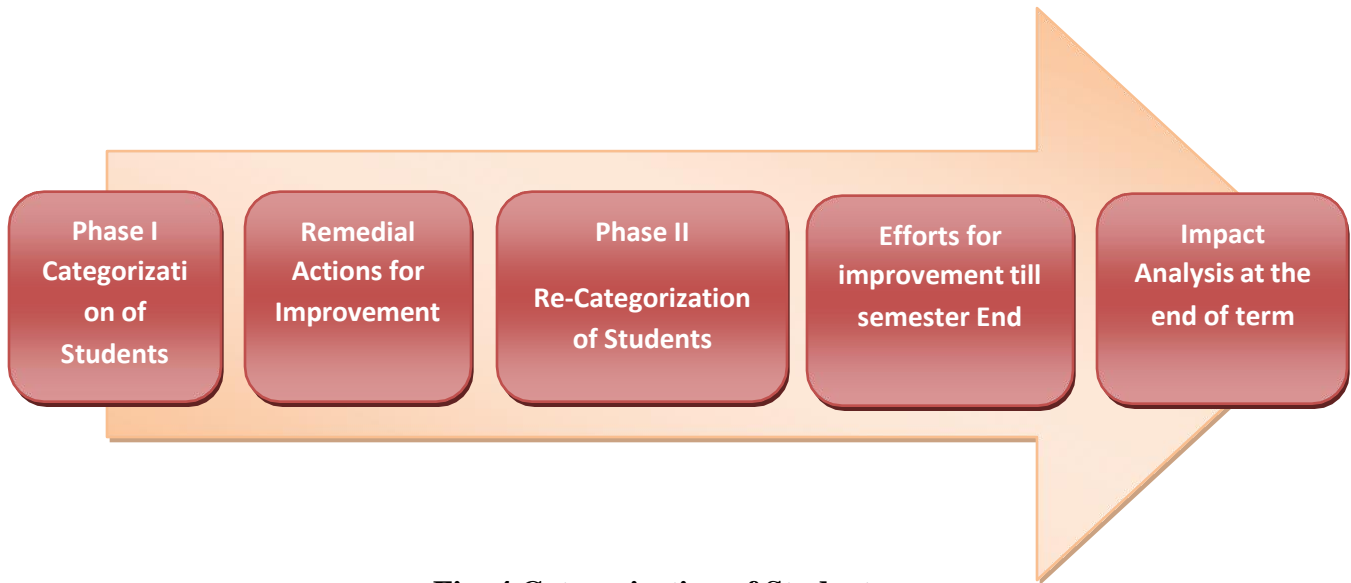


Fig: 4 Categorization of Students

Special Initiatives for Slow/Weak learners:

- Counselling by faculty mentors/ members.
- Remedial Classes and Makeup Classes.
- Doubt clearing sessions by course faculty.
- Provide simplified study materials (Short notes & Solution of previous years' HSBTE question papers).
- PTM / Periodic interaction with parents through HOD.

Special Initiatives for Advanced/Bright learners:

- Encourage to participate in seminars, workshops, conferences & technical quizzes.
- Encourage to take up Swayam, NPTEL course and other value added courses.
- Encourage to participate in Smart India Hackathon and project competitions.
- Motivation to prepare for competitive exams.
- Strategies for Slow and Advanced Learners

List of Assessment Tools

All (Direct + Indirect) CO Assessment Tools = PO Direct Assessment Tools Sample

CO Assessment Tools

- Sessional
- Assignment
- Practical/ Lab work
- HSBTE Exam
- Course Exit Survey
- Stakeholders Feedback

Direct and indirect attainment of POs and PSOs

The assessment used to evaluate program outcomes (POs) and program specific outcomes (PSOs) can be broadly classified into direct attainment and indirect attainment. Direct attainment is calculated jointly through the internal evaluation by the institute as well as the HSBTE examination. Indirect attainment is carried out through student exit surveys.

Theory course's assessment tools

The theory course evaluation process consists of internal and HSBTE examinations. Internal evaluation process includes sessional tests and assignments.

Setting Course Outcome attainment targets for internal and HSBTE examinations

In every educational program, the concerned department is expected to decide on the target attainment levels. It is like setting one's own program's standards. If a low target is set, it becomes easy to attain but in long run it degrades educational quality or the program strengths. Therefore the attainment targets are gradually improved over the years so that enough challenges continue to exist in place to improve the quality. Table 5 presents the target attainment statements to be used for internal sessional tests and the HSBTE examinations.

Table below is An example of CO attainment targets applicable to internal and HSBTE examinations

Attainment Level Achieved	If the following target is accomplished
1	50% students scoring 50% marks or more, out of the maximum marks
2	60% students scoring 50% marks or more, out of maximum marks
3	70% students scoring 50% marks or more, out of maximum marks

- It varies with the toughness level of course.

CO Attainment through internal Assessment tools

The institute conducted two sessional tests in every semester. Every student has to submit two assignments for each course. All the questions in the sessional test and assignments are mapped with the Course outcomes. Based on marks obtained by the students for each COs in sessional tests and assignments, the CO weightage is calculated by giving 60% weightage to the sessional test and 40% to the assignments as presented in Table 6.

Table 6. CO Attainment through internal Assessment tools (Assignments + Sessional Tests)

S.No.	Roll No.	Name	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
1	16CE001	MANISHA	33	4.8	5.2	6.6	10	6.2	0.4
2	16CE002	MENKA	34	3.4	4.4	7.4	11.4	4.6	2.4
3	16CE003	RAJNI	29	2.2	2.8	8.2	9.4	5.6	1.2
4	16CE004	SONIKA	29	4.4	6	3.6	10.4	3.4	0.8
5	16CE005	SRUTHI M NAIR	26	3.6	3.4	3.4	8.6	4.6	2
6	16CE006	SULEKHA	32	4.4	5.4	8.2	9	4	1.2
7	16CE007	ABHIMANYU KUMAR	32	4.4	5.6	6.8	9.4	5.6	0.4
8	16CE008	ABHISHEK KUMAR	28	3.6	4.8	8.2	6.8	4.6	0.4
9	16CE010	AMIT KUMAR	30	5.4	5	5.6	8.6	4.8	0.8
10	16CE011	AMIT KUMAR	35	3.6	5.2	10	10.4	5.2	0.4
Weightage of COs (60% of Sessional Test + 40% of Assignments)				4.4	9.2	7.2	7.2	10	4
Target Percentage of COs			50%	2.2	4.6	3.6	3.6	5	2
Percentage of Students Achieved CO target				100.00	70.00	90.00	100.00	40.00	20.00

The target set for the theory courses is decided by the department, say in this example is 50%. In Table 6 the weightage and target of COs is shown. For Example, the weightage of CO1 is 4.4 and the target is 2.2 (50% of the weightage). The percentage of students who score equal to or more than 2.2 is calculated. Here, 100% of students achieved the target of CO1. Similarly, the percentage of students achieved the target is calculated and presented in Table 6.

2.6 CO Attainment through External Assessment tools

The HSBTE examinations for every program are conducted semester wise. The CO wise marks are calculated from the HSBTE question papers. Say for example, in B.Tech Program the question paper is of 180 marks (9 questions, 20 marks each) and the students have to attempt 5 questions (Maximum 100 marks). The COs are calculated according to 180 marks and converted into weightage of 100 marks. Then from the marks obtained by the students in HSBTE examinations, the percentage of students achieving the target is calculated as presented in Table 7.

Table 7. CO Attainment through External Assessment tools (Board Exams)

S.No.	Roll No.	Name	Total Marks 100	CO1	CO2	CO3	CO4	CO5	CO6
1	16CE001	MANISHA	30	1.67	13.33	8.33	3.33	1.67	1.67
2	16CE002	MENKA	80	4.44	35.56	22.22	8.89	4.44	4.44
3	16CE003	RAJNI	42	2.33	18.67	11.67	4.67	2.33	2.33
4	16CE004	SONIKA	64	3.56	28.44	17.78	7.11	3.56	3.56
5	16CE005	SRUTHI M NAIR	57	3.17	25.33	15.83	6.33	3.17	3.17
6	16CE006	SULEKHA	53	2.94	23.56	14.72	5.89	2.94	2.94
7	16CE007	ABHIMANYU KUMAR	30	1.67	13.33	8.33	3.33	1.67	1.67
8	16CE008	ABHISHEK KUMAR	52	2.89	23.11	14.44	5.78	2.89	2.89
9	16CE010	AMIT KUMAR	12	0.67	5.33	3.33	1.33	0.67	0.67
10	16CE011	AMIT KUMAR	50	2.78	22.22	13.89	5.56	2.78	2.78
Weightage of COs in HSBTE Examination				5.56	44.44	27.78	11.11	5.56	5.56
Target Percentage of COs			50%	2.78	22.22	13.89	5.56	2.78	2.78
Percentage of Students Achieved CO target				60.00	60.00	60.00	60.00	60.00	60.00

Direct CO Attainment through External and Internal Assessment tools

The combined CO attainment is calculated through external and internal assessment tools is presented in Table 8. The 70% weightage is given to the target achieved through external assessment tools and 30% weightage is given to the target achieved through internal assessment tools. Accordingly the Direct CO attainment level is calculated by using the target set shown in Table 5. For Example, the attainment for CO1 is 3 as the percentage of students achieved the target is 72%. Similarly the Direct CO attainment level for the entire COs is calculated and presented in Table 8.

Table 8. Direct CO Attainment through External and Internal Assessment tools

CO	Percentage of Students Achieved Target Through External Assessment Tools	Percentage of Students Achieved Target Through Internal Assessment Tools	Percentage of Students Achieved Target =External * 0.7 + Internal * 0.3	Direct CO Attainment Level (X _m)
CO1	60	100	72	3
CO2	60	70	63	2
CO3	60	90	69	2
CO4	60	100	72	3
CO5	60	40	54	2
CO6	60	20	48	1

External

CO1 target of 50% achieved by 60% students
 CO2 target of 50% achieved by 60% students
 CO4 target of 50% achieved by 60% students
 CO5 target of 50% achieved by 60% students
 CO6 target of 50% achieved by 60% students

Combined

CO1 target of 50% achieved by 72% students
 CO2 target of 50% achieved by 63% students
 CO3 target of 50% achieved by 69% students
 CO4 target of 50% achieved by 72% students
 CO5 target of 50% achieved by 54% students
 CO6 target of 50% achieved by 48% students

Internal

CO1 target of 50% achieved by 100% students
 CO2 target of 50% achieved by 70% students
 CO4 target of 50% achieved by 100% students
 CO5 target of 50% achieved by 40% students
 CO6 target of 50% achieved by 20% students

Attainment Level

CO1 Attainment Level is 3
 CO2 Attainment Level is 2
 CO3 Attainment Level is 2
 CO4 Attainment Level is 3
 CO5 Attainment Level is 2
 CO6 Attainment Level is 1

Percentage of Students Achieved Target	Indirect CO Attainment Level
Below 50%	1
50%-70%	2
Above 70%	3

Table 8(b). Indirect CO Attainment through Course Exit Survey

CO	Percentage of Students Achieved Target	Indirect CO Attainment Level (Y _m)
CO1	90	3
CO2	80	3
CO3	60	2
CO4	90	3
CO5	50	2
CO6	60	2

Closure: Attainment levels of all the courses taught in a session are computed as per the procedure described in this section and compiled in a tabular form separately for each PO and PSO. Similarly the PO and PSO attainments of other courses are also evaluated and combined in the same table. Once all the courses are included in the attainments, the gap identification process is deployed and remedial measures are decided and placed into practice.

REFERENCES

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