

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous, 'A' Grade and College with Potential for Excellence)

Ooty Road, Mysuru-570025, Karnataka, India

Contact: 0821 – 2548236/2548380; Website: jsscacs.edu.in; E-mail: jssautonomous@gmail.com



OUTCOME BASED EDUCATION

Manual (2022-23 Version)

Prepared by IQAC

Content

1	Vision, Mission and Objectives of the Institute	2
2	Outcome Based Education (OBE) Framework	3
3	Composition of Executive Committee & Responsibilities.....	4
4	Definitions of PEOs, POs, PSOs, GAs & COs.....	4
5	Revised Blooms' Taxonomy	7
6	Action Verbs for Course Outcome.....	8
7	Guidelines for Writing Course Outcome Statements.....	9
8	Quality of Course Outcomes & Validation.....	10
9	CO-PO Mapping Guidelines	11
10	Setting targets for attainments & Attainment Levels	13
11	Rubrics for Assessment.....	15
12	Activity Based Learning	16
13	List of Assessment Tools	17
14	Student Competency	18
15	CO Attainment Calculations	19
16	Overall Attainment of POs or PSOs (Contribution of COs)	20
17	Sample Illustration: Mapping and attainment calculation.....	22
18	Continuous Improvement.....	26
19	Documents Repository	26
20	References.....	27

Preamble

Outcome-based education (OBE) is an educational theory or pedagogy that places students at the centre of an academic program. It presupposes that by the end of a learning session, each student would have attained a level of mastery of the course so as to be in a position to realize on the completion of the course, a standard of achievement. The realization of the standard in all the courses which together constitute a program is the end goal. If through the Course outcomes (COs) in all the courses in the curriculum, certain Program outcomes (POs) are not addressed or attained, then it is said that there are curricular gaps in achieving the POs. These curricular gaps are addressed through co-curricular and extra-curricular activities, which are beyond the curriculum. For success of learners through OBE the faculty may adapt the role of trainer, facilitator, instructor, and/or mentor based on the outcomes targeted.

In the fulfilling of the desired goal, the teacher is provided considerable latitude. Unlike the past, OBE is a student centric approach and the teacher's role is to facilitate, guide and mentor.

From 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) is the autonomous body for promoting global quality standards for technical education in India. In 2017 in its revised accreditation framework (RAF) the NAAC has introduced the assessment of students outcomes through OBE pattern for each program. Reports of outcome analysis help to find gaps and carryout continuous improvements in the education system of an Institute, which is very essential.

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 student's 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 students to feel responsible for their own learning, and they should learn more through this individual learning

Vision

To be known as an institution providing need-based, skill-integrated, cost-effective, quality and holistic education, transforming the students into globally competitive, employable and responsible citizens and to be recognized as a center of excellence.

Mission

- To create and acquire relevant knowledge along with skills and global competencies and disseminate the same among students
- To provide holistic education through relevant curricula, programmes and pedagogic innovations focusing on employability and self-employment
- To undertake research work contributing to the creation of knowledge, skills and its applications for sustainable development.
- To establish linkage and collaborations for the betterment of teaching, learning, research and extension
- To provide good infrastructure, human resource and necessary support-services for the betterment of students' progress and welfare
- To promote national integration, human rights, universal brotherhood and community development activities through inclusive practices.

Objectives

- To determine and prescribe its own programmes of study and syllabi, and restructure and redesign the courses to suit local needs, make it skill oriented and in consonance with the job requirements
- To prescribe rules for admission in consonance with the reservation policy of the state government/national policy
- To promote research in relevant fields
- To evolve methods of assessment of students' performance, the conduct of examinations and notification of results
- To use modern tools of educational technology to achieve higher standards and greater creativity; and
- To promote healthy practices such as community service, extension activities, projects for the benefit of the society at large, neighbourhood programmes.

OBE Framework of the Institute

JSS College of Arts, Commerce and Science, an Autonomous Institution of University of Mysore, endeavors to proactively participate in the mission of Indian Higher Education System to enhance the academic quality to foster quality excellence. The objective is to elevate the competency levels of the Graduates to meet the global demands. The meticulous and stringent educational methodology of Outcome Based Education (OBE) is followed to enrich the student learning through performance outcomes. The model aims to maximize student learning outcomes by developing their skills. The OBE model supports the graduates to attain intellectual knowledge, skills and attitudes in order to ensure the holistic learning environment with clarity, flexibility, comparison and efficient involvement.

Scope of OBE

The OBE framework provides the guidelines to enable teaching and learning process of the institution to attain international recognition and global employment opportunities. It leads to enable the graduates to excel in their profession and career accomplishments.

- The OBE guidelines are applicable to all the students and faculty members
- The guidelines laid herein are applicable to all the academic programmes, courses, curricular activities undertaken by the members

Objectives

The objectives of the OBE policy are stated as follows:

- To design Learner Centric and Outcome-Based Curriculum.
- To define Programme Educational Objectives (PEO's) and Graduate Attributes in alignment with the vision and mission of the Institution.
- To define Programme Outcomes (PO's) to achieve the graduate attributes.
- To define Programme Specific Objectives (PSO's) and Course Outcomes (CO's) for all the programmes.
- To ensure the development of learner centric course content.
- To empower the facilitators to be effective in OBE Implementation.
- To state rubrics for attainment of outcomes at course and programme levels.

OBE Executive Committee

The committee for shouldering the responsibilities of fabricating and implementing OBE in the college is constituted. The composition is as given below.

Chief Executive	: Advisor
Principal	: Chairman
Senior faculty from each domain	: Conveners
Controller of Examinations	: Member
IQAC Representative	: Member
Faculty Nominee	: Coordinator
HoDs/Few Nominees	: Members

Roles and Responsibilities:

- To design the policies, structure of OBE Curriculum and Evaluation of outcomes.
- Shall provide the training and guidelines to implementation of OBE.
- Monitoring of strategies for OBE and conduct annual review to ensure the effective implementation.
- To define the Programme Educational Objectives and Graduate Attributes.
- To guide the departments to define Programme Outcomes, Programme Specific Outcomes and Course Outcomes.
- To review the outcome attainments periodically.
- To ensure the quality assurance of the curriculum, pedagogical teaching methods of the institutions to attain the outcomes.

Definitions:**Programme Educational Objectives (PEOs):**

A set of 3 to 5 Programme Educational Objectives (PEOs) should be determined based on the mission and vision statement of the Institution. The PEO framed statements shall describe the student's career and professional accomplishments within 5 years after graduation. These are the statements that describe what the students are expected to know or be able to do by the time they complete an academic degree/qualification. The PEOs are different from the students' learning outcomes in the perspectives:

- Degree of specificity
- Role of Constituents

- Purpose of Assessment and
- Cycles of data collection

The PEOs should be mapped with the Mission and Vision of the Institution.

Program Learning Outcome (PLOs)

The PLOs are determined based on the graduate attributes or the skills. The PLOs are to be mapped with the PEOs and the Blooms Taxonomy of verbs. The abilities (Cognitive, Psychomotor and Affective) that a student should be able to demonstrate at the time of graduation. The Programme learning outcomes are description of student's knowledge, competencies, and value a student display at the time of completion of graduation.

Graduate Attributes (GAs)

They are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. GAs forms a set of individually assessable outcomes of the programme.

S. NO.	GRADUATE ATTRIBUTES
1	Subject Knowledge
2	Problem Analysis
3	Design and Development of the Solution
4	Usage of Technology
5	Application of Knowledge in Society
6	Environment and Sustainability
7	Ethics and Values
8	Individual and Team Work
9	Effective Communication
10	Life Long Learning Ability
11	Culture, Patriotism and International Outlook
12	Positive Attitude and Open Mindedness

Programme Specific Outcome (PSOs)

The programme specific outcomes (PSOs) are the statements about what the students should be able to do at the time of graduation. The PSO's are programme specific and are written by the department which is offering the programme.

Programme Outcome (POs)

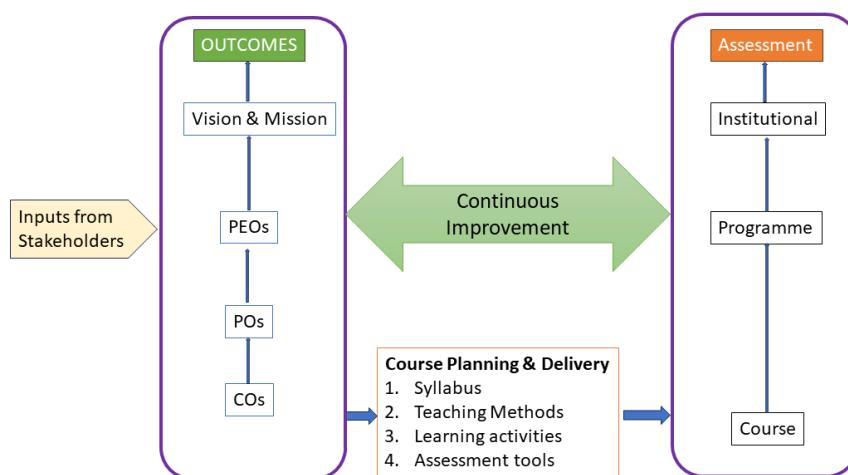
Program outcomes are specific statements outlining the skills and abilities students should possess upon graduation. These outcomes should closely align with Graduate Attributes.

Course Outcome (COs)

Depending upon the graduate attributes and the mapping of PLOs, the Course Learning Outcomes will be framed. The Course Learning outcome should follow the Blooms Taxonomy of verbs. Specific statements of what the students are expected to achieve at the end of the course. The course curriculum is measurable, observable and clearly indicates what a student should know and be able to do as a result of learning. The course learning outcome should satisfy the following conditions:

- Each course will address three to four CO statements
- Should be mapped Learning domains of Blooms or other Taxonomy of verbs
- There should be one to one mapping with the CO and PO statement. i.e. One CO should be mapped with One PO
- Expressed in terms of measurable and achievable form
- There should be an action Verb + Standard or Verb + Condition or Verb + Standard + Condition.
- Multiple PO, CO and taxonomy of verbs should not be reflected in a single CO statement.

The implementation of an outcomes-based education, which promotes the practice of constructive alignment between outcomes, learning activities and assessment tools needs an environment where all stakeholders (teachers, students and the institutions) are engaged in the process of transformative reflection and constant action. Each of these participants reflects in interaction with the others in three domains: teacher and student, teacher and institution, student and institution that would have built-in quality enhancement and mechanisms for not only assuring quality but for enhancing quality. The overall OBE framework developed in our HEIS is given in below scheme.

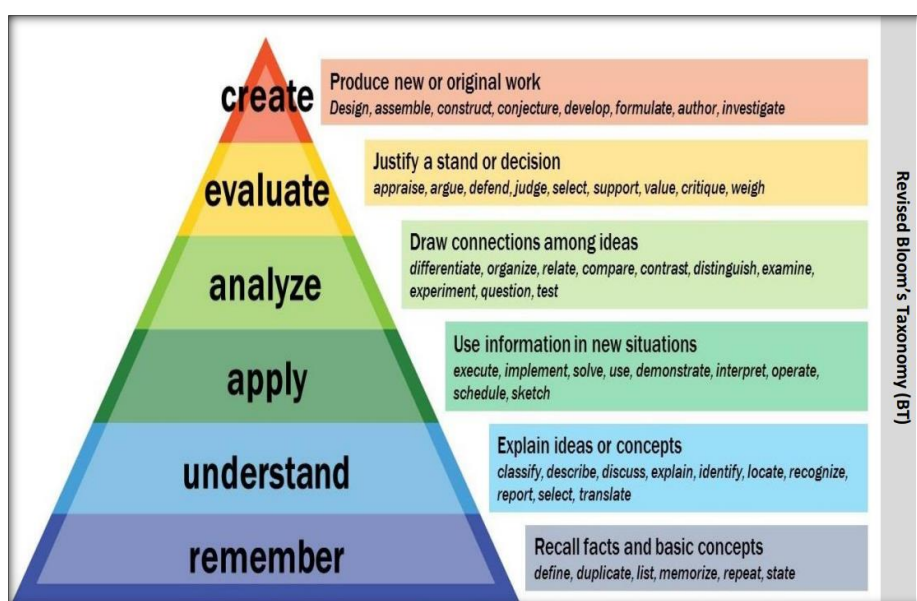


Scheme: OBE framework in the institute

Revised Bloom's Taxonomy

Bloom's taxonomy is a popularly adopted framework for categorizing educational goals. These are widely used in teaching, learning and assessment, to make students go through various levels incognitive domain of learning. According to revised Bloom's taxonomy, the levels in cognitive domain are as follows:

- 1. Remembering:** Recalling from memory of previously learned material.
- 2. Understanding:** Explaining ideas or concepts.
- 3. Applying:** Using information in another familiar situation.
- 4. Analyzing:** Breaking information into part to explore understandings and relationships.
- 5. Evaluating:** Justifying a decision or course of action.
- 6. Creating:** Generating new ideas, products or new ways of viewing things.



Bloom's Taxonomy is hierarchical, meaning that learning at the higher level requires that skills at lower level are attained.

Action Verbs for Course Outcomes

Sample Action Verbs

Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyze	Evaluate	Create
Define	Explain	Solve	Analyze	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summarize	Calculate	Distinguish	Recommend	Formulate
Match	Compare	Sketch	Explain	Grade	Invent
Tabulate	Discuss	Prepare	Differentiate	Measure	Develop
Record	Estimate	Chart	Appraise	Test	Organize
Label	Express	Choose	Conclude	Evaluate	Produce

Illustration (use of action verb with respect to knowledge dimension and order of thinking):

Use of action verbs	Factual	Conceptual	Procedural	Meta cognitive
Remember (K1)	List properties of soil	Recognize characteristic of material	Explain working of pump	Identify strategies for report writing
Understand (K2)	Summarize features of a new product.	Classify adhesives by toxicity.	Explain assembly instructions.	Predict the behavior of member
Apply (K3)	Solve the following and arrive to value of energy.	Illustrate composition of soils.	Carry out pH tests of water samples.	Use modern techniques to get solution
Analyse (K4)	Explain the selection of tool/activity .	Differentiate LOT and HOT	Integrate compliance with regulations.	Assess The project work
Evaluate (K5)	Select the appropriate tool	Determine relevance of results.	Judge efficiency of sampling techniques.	Reflect on one's progress.
Create (K6)	Generate a log of daily activities.	Assemble a team of experts.	Design efficient project work flow.	Create a learning portfolio.

The cognitive process dimensions categories					
Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyze	Evaluate	Create
Recognizing (identifying) Recalling (retrieving)	Interpreting Illustrating Classifying Summarizing Inferring (concluding) Comparing Explaining	Executing Implementing	Differentiating Organizing Attributing	Checking (coordinating, detecting, testing, monitoring) Critiquing (judging)	Planning Generating Producing (constructing)

Guidelines for Writing of Course Outcome Statements

COs are written by involving:

- Action verb
- Subject content
- Level of achievement as in BTL
- Modes of performing task (Optional if applicable)

Some examples with illustration for writing COs:

After successful completion of this course students will be able to:

- Design a procedure to separate organic acids and bases. **Action verb** (underlined)
- Determine the purity of real samples. **Subject content**
- Use chromatography tools to a competent Level. **BTL**
- Present the applications of chromatographs for real life problems. Modes of performing **task** with action verb (underlined)

While writing CO's the following questions/points must be addressed properly.

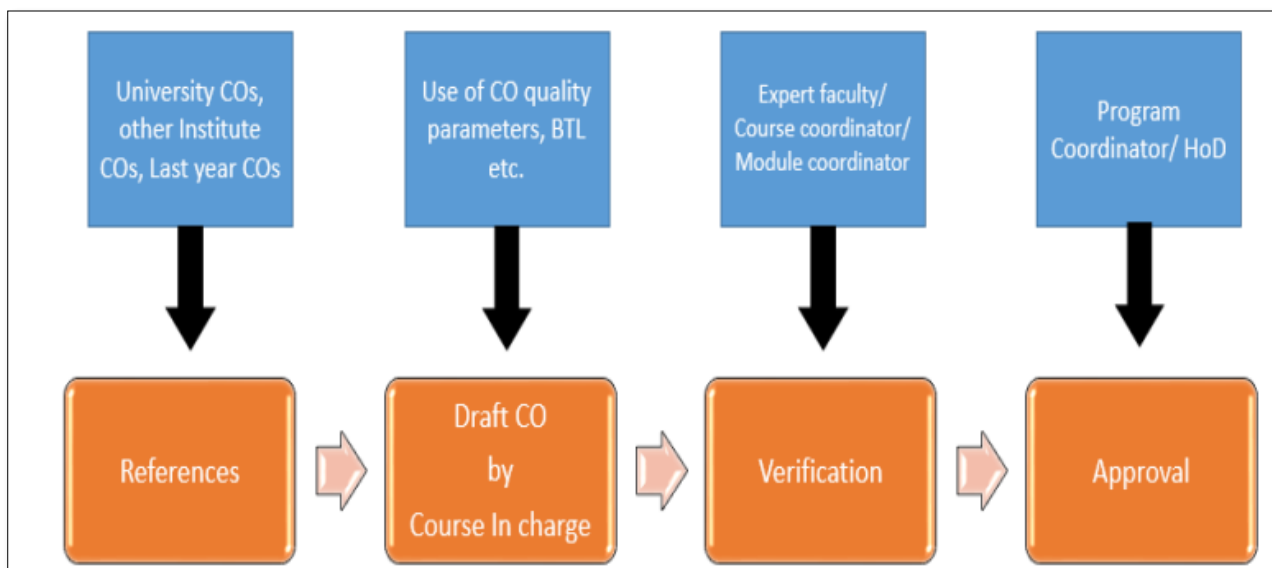
Specific	Is there a description of precise behaviour and the situation it will be performed in? Is it concrete, detailed, focused and defined?
Measurable	Can the performance of the outcome be observed and measured?
Achievable	With a reasonable number of efforts and application can the outcome be achieved? 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, percentage or frequency clearly stated? When will this outcome be accomplished?

Note: COs are to be written separately for practical courses.

Number of COs	2 to 4
CO essentials	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
Based on BTL	Understand, Remember, Apply, Analyse, Evaluate, Create
Number of BTL Considered in one course	Minimum 3
Technical Content/ point of curriculum	All curriculum contents are covered
Curriculum gap	Additional CO for gap identified/filling. Adds more weightage

Quality of COs to be validated!!!!

Process to be followed at department level to maintain quality of CO:



CO-PO Mapping Guideline

Consider Any Two Minimum Criteria for CO-PO Mapping Justification

I. Contact Hours: Lecture, Tutorial and Practical:

Level	Contact Hours in Percentage (including Lecture, Tutorial & Practical)
No mapping(-)	<5%
Low(1)	5-15%
Medium(2)	15-25%
High(3)	>25%

Description: Number of Lectures = 3 per week \times 12 weeks = 36 **Hours (Theory)**

OR

Number of Practicals = 2 per week \times 4h \times 12 weeks = 96 **Hours (Practicals)**

OR

10 Lectures h (Th) + 1 x 12 h (Tut) h + 2 x 2 x 12 h (Prac) = 70 Hours (**L:T:P**)
Course

Examples:

- Let, CO1 related points are engaged in 8 lectures of theory paper,
Therefore, contact h in percentage = $(8/36) \times 100 = 22.22\%$ (Medium Mapping: 2).
- Let a course of 70 h has a CO related to 8 h of Lectures + 4 h of Tutorials + 26 h of Practicals,
Then, contact h in percentage = $(38/70) \times 100 = 54.2\%$ (High Mapping : 3)

II. Number of Assessment Tools used:

Level	Assessment tools used to assess the CO
No mapping (-)	0
Low (1)	1 or 2
Medium (2)	3
High (3)	4 or more

Description

CO assessment tools \rightarrow Mid-term test, end term test, class test, oral, Continuous internal assessment (Assignment, Lab practical assessment), course exit survey, University theory exam, OE/POE, external feedback, Activities (Survey, guest lecture, workshop, seminar, case studies, mini/minor projects etc. Every CO must be correlated with each PO and appropriate mapping may be selected.

III. Key words: Appropriate keyword is sufficient for mapping.

Level	Keywords Used in writing CO's
No mapping (-)	Keywords 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 + moderate level performance is expected from student to achieve PO
High (3)	Exact action verb of PO + critical performance expected from student to achieve PO

CO-PO Mapping (Guidelines) & CO Attainment Calculations

The effective implementation of OBE is complete with mapping and attainment level of computation.

- Course Outcomes shall be mapped with Programme Outcomes.
- One CO may be mapped with more than one PO and vice versa.
- It must be ensured that all CO's are sufficient to measure the attainment level of PO's.
- The attainment must be measured at each programme and course level.

The Following template shall be used to implement the mapping of CO with PO and PSO:

CO-PO MAPPING										
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	–	2	–	1	3	2	3	3	3
CO2	1	3	–	1	–	2	3	3	3	3
CO3	–	2	–	3	1	3	3	2	3	3
CO4	–	–	1	–	3	2	2	3	2	3
CO5	–	1	3	2	–	2	2	2	2	2
WT.AVG	2	2	2	2	1.67	2.4	2.4	2.6	2.6	2.8
OVERALL MAPPING OF SUBJECT										2.247

Setting targets for attainments

The following chart illustrates the means for setting the attainment targets.

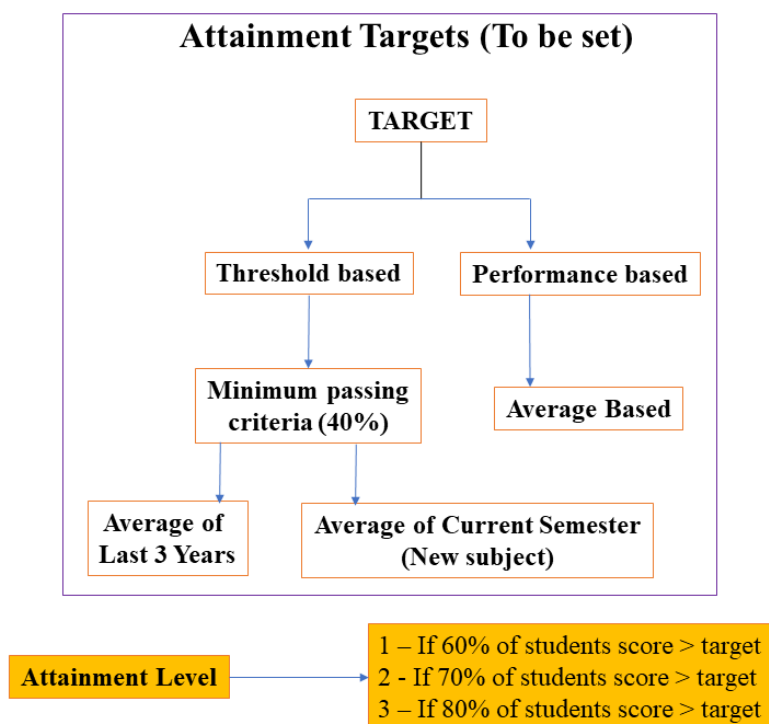


Illustration of the above chart for attainment targets:

Case of Course	Avg % result in last year/ 3 years	Clue for keeping target	Attainment 1 if	Attainment 2 if	Attainment 3 if
Course 1	<40 %	Threshold	40 % cross target	50% cross target	60% cross target
Course 2	Above 40% but less than 50%	Threshold with high attainment level	60 % cross target	70% cross target	80% cross target
Course 3	Above 50 %	Average based	40 % cross target	50% cross target	60% cross target
Course 4	Above 80%	Average based with high attainment level	60 % cross target	70% cross target	80% cross target

Let, be assumed for instance the scores obtained by students and corresponding mapping in the table below:

CO	DISTRIBUTION %								
	3(HIGH)			2(MEDIUM)			1(LOW)		
	No. of Students Attained	Total No. of Studs.	%	No. of Studs. Attained	Total No. of Studs.	%	No. of Students Attained	Total No. of Studs.	%
CO1	54	60	90	6	60	10	0	60	0
CO2	54	60	90	6	60	10	0	60	0
CO3	57	60	95	3	60	5	0	60	0
CO4	57	60	95	2	60	3.33	1	60	1.67
CO5	56	60	93.33	2	60	3.33	2	60	3.33

Rubrics	3	70 % of Students above 50%
	2	60 % of Students above 50%
	1	50 % of Students above 50%

Attainment through assessments:**Let the assessment through Tests and Assignment:**

CO CODE	TEST1	TEST2	Assignment	INTERNALs for 3	ESE
CO1	3	0	3	3	3
CO2	3	0	2	2.67	3
CO3	0	3	3	3	3
CO4	0	3	2	2.67	3
CO5	0	0	3	3	3
INTERNAL/UNIV ATTAINMENTS				2.9	3
Weightage				30%	70%

Corresponding attainment: 30% of 2.9 for Internal Assessment = $0.30 \times 2.9 = 0.87$

75% of ESE = $0.70 \times 3 = 2.10$

Final Subject CO attainment $0.87 + 2.10 = 2.97$

PO ATTAINMENT USING CO ATTAINMENTS (DIRECT METHOD):

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	—	2	—	1	3	2	3	3	3
CO2	1	3	—	1	—	2	3	3	3	3
CO3	—	2	—	3	1	3	3	2	3	3
CO4	—	—	1	—	3	2	2	3	2	3
CO5	—	1	3	2	—	2	2	2	2	2
WT.AVG	2	2	2	2	1.67	2.4	2.4	2.6	2.6	2.8
PO ATTAINMENT USING CO (DIRECT METHOD)*	1.98	1.98	1.98	1.98	1.65	2.38	2.38	2.57	2.57	2.77

*PO Attainment = $WT.AVG/3 \times 2.97$

Rubrics for Assessment

Rubric is a scoring guide with criteria for evaluating students' work in direct relation to one or more of the PO's and a rating scale indicating differing levels of performance.

Rubrics are:

- Used to examine how well students have met CO or PO rather than how well they perform compared to their peers.
- Typically include measurable descriptors that define expectations at each level of performance for each criterion.

Sample Rubrics for CO assessment in Laboratory: (10 Marks)

Category	Performance Levels		
	3 marks	2 marks	1 marks
Performance in Lab	<ul style="list-style-type: none"> • Able to perform experiment independently within prescribed time • The result is close or to standard value. 	<ul style="list-style-type: none"> • Able to perform experiment within prescribed time • Large deviation of result from standard value 	<ul style="list-style-type: none"> • able to perform the experiment
Level of Understanding/ Q&A	<ul style="list-style-type: none"> • able to show strong theoretical background of experiment • able to interpret proper data to reach conclusion 	<ul style="list-style-type: none"> • partially show strong theoretical background of experiment • * Partially able to interpret data to reach conclusion. 	<ul style="list-style-type: none"> • lack of theoretical background of experiment or lack of interpretation of data
	Documentation Level		
	4 marks	3 marks	2 marks
Quality of Submission	<ul style="list-style-type: none"> • Graphs, table, contents are well constructed. • All-important calculations and result have been clearly made. • Conclusions/ observations/ comments 	<ul style="list-style-type: none"> • Shortfalls found in any of the contents of the report viz. graphs, tables, calculations, results, conclusions. Comments etc. 	<ul style="list-style-type: none"> • Report submitted but not written properly.

	done clearly		
--	--------------	--	--

Rubric maximum score = 4+3+3 (high marks) = 10 (100%)

Rubric minimum score = 1+1+2 (low marks) = 4 (40%)

Sample Rubrics for Individual & Team Work

Rubric Category	Level of Performance			
	4	3	2	1
Group Leader	Seeks opportunities to lead; in leader 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
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
Cooperation	Always cooperative with all members, support good initiatives	cooperative with members, but sometimes resist	cooperative with few members, and resist most of time	Non-cooperative

Activity based learning

Learning by:

- Individually
- Solving problems
- Questioning and answering
- Doing hands-on
- Team work

Some of the Examples:

MOOCs, Flipped Classroom, Round Robin, Collaborative Learning, Puzzle, Matrix Method, Peer-Learning, Work-Based Learning, Problem-Based Learning, Personalized Learning, Group Discussion, and Debate, Case Studies etc.

Assessment Tools

All (Direct + Indirect) CO assessment tools = PO Direct assessment tools

Some mention of sample CO assessment Tools:

- Mid Term Test
- End Term Test
- Quiz
- Assignment
- Practical/ Lab work
- Industrial Visit, Workshop
- Other Task/Activity
- End Semester Examination
- Viva
- Course Exit Survey
- External Feedback (External Examiner/Trainer, Campus Placement Technical Expert)

Direct Tools: Assessment by faculty in the HEI (for CO with marks)

Indirect Tools: Assessment not in terms of Marks w.r.t CO

Indirect Attainment Calculation

The feedback from the following aspects are used as rubrics:

- Current Passing out Students
- Stakeholders
- Alumni
- Survey from Employer of Alumni

The questions in the survey sheet represented the PO'. All these survey needs to be a quantified one (1, 2, 3) and there must be based on predefined levels like Rubric's defined for direct calculation. Sample rubrics are facilitated below.

Rubrics for Attainment Calculation

60% People are giving above 3 – 1 (LOW)
70% People are giving above 3 – 2 (MEDIUM)
80% People are giving above 3 – 3 (HIGH)

Survey	Indirect Attainment									
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
Current Passing out students	3	2	3	3	3	2	3	2	2	1
Alumni	3	2	3	1	2	3	2	1	3	2
Survey from placement Cell	3	3	2	3	3	1	2	3	2	1
Indirect PO Attainment	3	2.33	2.67	2.33	2.67	2	2.33	2	2.33	1.33

Student Competency

Base Score for Student Category

- 1) <50% - Slow Learner
- 2) 50% to 65% - Average Learner
- 3) >65% - Advanced Learner

Strategies for Slow, Average and Advanced Learners

For Slow learners

- Document/record of remedial classes with timetable & attendance
- Specially designed assignment/ task
- Student study group for peer-to-peer learning
- Individual Counselling
- Student help desk

Note: For the benefit of slow learners the remedial sessions should be conducted once in a week.

For Average Learners

- Additional assignment/ task
- Encouraging for timely and effective completion of work
- Conduction of quiz, orals etc.
- Solving previous year question papers and test papers
- Presentation on technical topics/ case studies/mini projects

Note: Activities should be on continuous basis.

For Advanced Learners

- Encouraging to present & publish papers in Journals/Conferences/Competitions
- Guidance for NET/SET/GATE/ or other competitive Examination
- Encouraging participating in professional activities.
- Specially designed activities to improve the portfolio of students.
- Individual guidance for career building

Note: Activities should be on continuous basis.

Attainment of CO: Calculations

Attainment weightage may be given as follows:

PO attainment

Direct: 80%; Indirect: 20%

Consider PO Assessment tools = CO Assessment tools (both direct and indirect methods)

Illustration of Internal Test Examination Attainment:

Course	Essentials of analytical chemistry
Maximum Marks	30
Number of Students Appeared	60
Passing Level (Threshold Based Target)	12 (40% of 30)

Assume from the list of the marks secured by all students it may be found that:

Number of students scored 12 or more marks	28
% of students achieving 12 or more marks	$(28/60) \times 100 = 46.6\%$

The Attainment levels are:

- 1 – if 40 % students score more than target
- 2 – if 50 % students score more than target
- 3 – if 60 % students score more than target

Then Attainment is = 1 (from 46.6%)

Illustration of Feedback/Rubric Based Assessment & Attainment:

Course	Essentials of analytical chemistry
Maximum marks	5
Number of students appeared	60
Passing level (Average Based Target)	3 (>50% here)

Number of students scored 3 or more score	37
% of students with 3 or more marks	$(37/60) \times 100 = 61.7\%$

Attainment levels are:

- 1 – if 40 % students score more than target
- 2 – if 50 % students score more than target
- 3 – if 60 % students score more than target

Then attainment is = 3 (from 61.7%)

Overall Attainment of CO

Assume that CO1 is assessed using any 2 direct + 2 Indirect CO assessment tools

Then,

Overall CO Attainment = (Weightage \times Direct CO attainment)

+

(Weightage \times Indirect CO attainment)

If the weightage for Indirect CO attainment is 20% (for both UG and PG programmes),

Overall CO Attainment = (0.8 \times Direct CO attainment) + (0.2 \times Indirect CO attainment)

where 0.8 and 0.2 are from 80 and 20% weightage for direct and indirect attainments.

Note: Percent weightage may be fixed in any number (as 80:20/90:10/70:30/75:25 etc) after deliberation in the department for programs.

Overall Attainment of POs or PSOs (Contribution of COs)

The overall attainment of POs or PSOs are obtained by using average mapping strength of individual PO to CO or PSO to CO, maximum mapping strength of 3 and average attainment of COs. The following formula is used to calculate it:

PO/PSO attainment = Attainment of CO_{Avg} \times Factor of Scale

Factor of Scale = Obtained mapping strength/ Maximum mapping strength

= Obtained mapping strength/3

Illustration 1:

PO	COs	Mapping Strength	PO/PSO Attainment= Factor of Scale \times Attainment of CO _{Avg} in % (or for weightage 3)
PO1	CO1, CO3	1	$(1/3)[(63+67)/2] = 22$
PO2	CO3	1	$1/3 (67) = 22$
PO3	CO4, CO5, CO6	3	$3/3 [(68+63+67)/3] = 66$
PO4	CO4, CO5, CO6	3	$3/3 [(68+63+67)/3] = 66$
PO5	CO4, CO5, CO6	3	$3/3 [(68+63+67)/3] = 66$
PO10	CO1, CO2	1	$(1/3)[(63+67)/2] = 22$
PSO1	All the 6 COs	3	$3/3 [(63+67+67+68+63+67)/6] = 66$

Illustration 2:

Let us assume CO-PO mapping of course (Before assessment or commencement of classes) in the following table.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	2	1	-	-	-	-	-	-	-	-	-	3	-	-
3	-	3	1	-	-	-	-	-	-	-	-	-	3	-	-
4	-	3	-	2	-	-	-	-	-	-	-	1	3	-	-
Average = Mapping Strength	3	3	1	2	-	-	-	-	-	-	-	1	3	-	-

The maximum mapping strength = 3 (High) for all the cases

Overall Attainment of COs after assessment: (with 80% direct and 20% indirect assessment)

CO	Direct Attainment (A)	Indirect Attainment (B)	Overall CO Attainment = $0.8 \times A + 0.2 \times B$
1	2	3	2.8
2	3	3	3
3	2	3	2.8
4	1	3	2.6

Hence, final CO to PO attainment is calculated as described before and summarized below:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	2.00	1.00	-	-	-	-	-	-	-	-	-	3.00	-	-
3	-	2.80	0.93	-	-	-	-	-	-	-	-	-	2.80	-	-
4	-	2.60	-	1.73	-	-	-	-	-	-	-	0.87	2.60	-	-
Average	2.80	2.50	0.96	1.73	-	-	-	-	-	-	-	0.86	2.80	-	-
%Attainment	93.3	83.3	32.0	57.6	-	-	-	-	-	-	-	28.6	93.3	-	-

Sample Illustration: Mapping and attainment calculation

ATTAINMENT CRITERIA	70		3		Threshold % for attainment			40		IT IS COMPULSORY TO ENTER THE NAME OF STUDENT									
	60		2	10	CO PASSING MARKS OUT OF 100			40											
	50		1	10	Please fill "AB" for Absent and "UR" for Unregistered candidate(s)														
JSS College of Arts, Commerce and Science, Ooty Road, Mysuru																			
Faculty Name:		Dr. N Rajendraprasad				Program		MSc				SUBJECT		Chemistry					
Prog		MSc		YEAR		I		SEM		1		COURSE CODE		21CHA13		SESSION		2022-23	
Attainment for Tests & End Semester Examination (ESE)																			
S. No.	Reg. No.	Name of Student	I Test					II Test					ESE	CO1	CO2	CO3	CO4	CO5	ΣCO
			CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	MM	%	%	%	%	%	%
		CO WISE MAXIMUM MARKS		3	4	3	0	0	0	0	2	2	6	80	100	100	100	100	100
1	JHCE2201	ABHISHEK SUBRAY SHET	1.00	2.00	3.00					2.00	2.00	4.00	56.00	33.33	50.00	100.00	100.00	66.67	70.00
2	JHCE2202	AFIYA TANZEM	1.00	3.00	3.00					2.00	2.00	3.00	65.00	33.33	75.00	100.00	100.00	50.00	71.67
3	JHCE2203	AISHWARYA N R	1.00	4.00	2.00					1.00	2.00	2.00	25.00	33.33	100.00	60.00	100.00	33.33	65.33
4	JHCE2204	AKSHATHA N K	1.00	3.50	1.00					1.50	1.00	4.00	60.00	33.33	87.50	50.00	50.00	66.67	57.50
5	JHCE2205	AMEER SUHAIL H	2.00	4.00	0.00					2.00	1.50	3.50	24.00	66.67	100.00	40.00	75.00	58.33	68.00
6	JHCE2206	AMRUTHA K S	2.00	2.50	1.00					2.00	1.00	3.00	56.00	66.67	62.50	60.00	50.00	50.00	57.83
7	JHCE2207	ANANYA H B	2.00	2.50	2.00					1.50	2.00	4.50	43.00	66.67	62.50	70.00	100.00	75.00	74.83
8	JHCE2208	ANUSHA C	3.00	3.00	2.00					1.50	2.00	5.00	52.00	100.00	75.00	70.00	100.00	83.33	85.67
9	JHCE2209	ANUSHA R	2.00	2.00	1.50					2.00	2.00	4.50	54.00	66.67	50.00	70.00	100.00	75.00	72.33
10	JHCE2210	APOORVA SANDHYA	1.50	2.00	2.50					2.00	2.00	3.00	65.00	50.00	50.00	90.00	100.00	50.00	68.00
11																			
12																			
13																			

OVERALL ATTAINMENT			ATTAINMENT TABLE	ABSENTEE+NOT ATTEMPT	0	0	0	0	0	0
1	Attainment through internal assessment:	2.13		PRESENT STUDENT OR ATTEMPT	10	10	10	10	10	10
2	Attainment through end semester examination:	3.00		NO. OF STUDENTS SECURE MARKS > THRESHOLD MARKS	8	6	10	10	10	9
3	Weightage given to the Internal examination (30%):	0.64		% OF STUDENTS SECURE MARKS > THRESHOLD MARKS	80.00	60.00	100.00	100.00	100.00	90.00
4	Weightage given to the End semester examination (70%):	2.10		Attainment ($3 \geq 70\%$, $2 \geq 60\%$, $1 \geq 50\%$)	3.00	2.00	3.00	3.00	3.00	3.00
5	Final attainment level of the course (by Direct Assessment):	2.74	Final attainment level CO (by Direct Assessment):		2.70	3.00	3.00	3.00	3.00	3.00

JSS College of Arts, Commerce and Science (Autonomous)															
FACULTY NAME:					Dr. N. Rajendraprasad										
Programme		MSc in Chemistry										SESSION:		2022-23	
COURSE:		Essentials of Analytical Chemistry				YEAR:		I				SEMESTER:		1	
SUBJECT:		CHEMISTRY								SUBJECT CODE:			MCHE		
PO ATTAINMENT USING CO (DIRECT METHOD)															
CO PO MAPPING															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	-	-	-	-	-	-	-	-	2	2	2	2
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	-	-	2	3	-	-	-	-	-	-	3	2	-	-
CO4	-	-	2	3	2	-	-	-	-	-	-	3	2	-	-
CO5	-	-	3	3	3	-	-	-	-	-	-	-	-	-	-
WT. AVG	2.00	2.00	2.67	2.67	2.67							2.25	2.00	2.00	2.00
										Overall Mapping of Subject					2.25

CO - PO-PSO ATTAINMENT																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	ATT
CO1	0.90	1.60	2.70									1.80	1.60	1.80	1.60	2.70
CO2	2.00	2.00										1.00				3.00
CO3	3.00			2.00	3.00							3.00	2.00			3.00
CO4			2.00	3.00	2.00							3.00	2.00			3.00
CO5			3.00	3.00	3.00											3.00
AVG	1.97	1.80	2.57	2.67	2.67							2.20	1.87	1.80	1.60	

Overall Attainment of Subject	2.13
-------------------------------	------

To be chalked out and implemented for continuous improvement

1. **Attainments at > 2.5 for 3:** Set higher targets for next year
2. **Attainments at < 2.5 for 3:** Record observation, work out plan to improve it w.r.t gaps
3. **Attainments are Very poor/Not attained:** Revise action plan and work out for better performance
4. **PO Attainments high:** Work for further HOTS
5. **POs not attained:** Prepare and implement plan for immediate effect for improvement
6. **Activities:** Critical assessment, impact analysis to be done and revise as per the need for improvements

Documents Repository

1. Vision & Mission of institute and programme
2. PEO of Program, PEO-PO/PSO mapping
3. COs, POs and PSOs of Programme
4. CO-PO/PSO mapping
5. Revised Blooms Taxonomy Level OBE framework
6. List of courses with codes
7. List of PO & CO assessment tools used
8. Course and Module Coordinators' details
9. Course curriculum and plan of delivery
10. Attainments levels and targets of all targets of courses
11. Rubrics
12. Assessment records
13. Documents on Slow and advanced learners
14. Exit survey docs and feedback
15. CO & PO attainment reports
16. Impact analysis of continuous assessments

References

1. Anderson, Lorin W & Krathwohl, David R. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives, Allyn and Bacon, ISBN 978-0-8013-1903-7.
2. Aoife Ahern, Caroline Dominguez, Ciaran McNally, John J. O'Sullivan & Daniela Pedrosa (2019). A literature review of critical thinking in engineering education, *Studies in Higher Education*, 44: 5, 816-828, DOI: 10.1080/03075079.2019.1586325
3. Examination reforms by AICTE-India:
<https://www.aicte-india.org/sites/default/files/ExaminationReforms.pdf>.
4. Huhta, Ari (2010). Diagnostic and Formative Assessment. In Spolsky, Bernard & Hult, Francis M. *The Handbook of Educational Linguistics*. Oxford, UK, Blackwell. pp. 469–482.
5. Jandhyala N Murthy (2012). Assessment Practices in Engineering – A Review, *The Journal of Engineering Education*, Vol.No.XXV-3, ISSN: 0971-5843.
6. Lavanya C, Jandhyala N Murthy, Satyanarayana Kosaraju, Chapter 4 (Feb 2020), *Assessment Practices in Outcome-Based Education: Evaluation Drives Education in Methodologies and Outcomes of Engineering and Technological Pedagogy* by IGI Global, pp 50-61, DOI: 10.4018/978-1-7998-2245-5.ch004.
7. Lorna M. Earl (2003). *Assessment as Learning: Using Classroom Assessment to Maximize Student Learning*. Thousand Oaks, California, Corwin Press, Inc.
8. Lavanya C, Jandhyala N Murthy. (2022) Assessment and Attainment of Course Outcomes and Program Outcomes. *Journal of Engineering Education Transformations* Volume 35 , No. 4, 2022, 104-111.
9. William G Spady (1994). *Outcome-Based Education: Critical Issues and Answers*. American Association of School Administrators, Arlington, ISBN 0876521839.
10. <https://www.mitmuzaffarpur.org/wp-content/uploads/2020/05/ppt-co-po-attainment-JNJ.pdf>
11. <https://coek.dypgroup.edu.in/wp-content/uploads/2020/06/DYP-OBE-Manual.pdf>.
12. Kaliannan, Maniam; Chandran, Suseela Devi (2012). "Empowering Students through Outcome-Based Education (OBE)". *Research in Education*. **87** (1): 50–63.
13. Butler, Mollie (2004). *OUTCOMES BASED/ OUTCOMES FOCUSED EDUCATION OVERVIEW*
14. Kennedy, Kerry (2011). "Conceptualising quality improvement in higher education: policy, theory and practice for outcomes based learning in Hong Kong". *Journal of*

- Higher Education Policy & Management*. **33** (3): 205–218.
15. Killen, Roy (2007). *Teaching Strategies for Outcomes-based Education, Second Edition*. Cape Town: Juta and Company Ltd. p. 48.
16. Allais, Stephanie (2007). "Education service delivery: the disastrous case of outcomes-based qualifications frameworks". *Progress in Development Studies*. **7** (1): 65–78.
17. <https://maryourhelp-cebu.edu.ph/index.php/outcome-based-education-obe-framework/>
18. Gurukkal, R. (2020). Outcome-Based Education: An Open Framework. *Higher Education for the Future*, 7(1), 1–4.
19. Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives: complete edition*. Addison Wesley Longman, Inc..