
# Outcome Based Education (OBE)Manual

*This handbook will provide guidelines to frame learning outcomes, assessment planning and evaluation for improving an academic program*

***IQAC-BSCOER***

**THE SHETKARI SHIKSHAN MANDAL's**

**BHIVARABAI SAWANT COLLEGE OF ENGINEERING & RESEARCH,**

(Approved by A.I.C.T.E. & Govt. of Maharashtra and affiliated to Savitribai Phule Pune University.)

# Guidelines and Procedures

This handbook is designed to assist faculty and administrators with the process of developing and/or revising expected learning outcomes and methods for assessing those outcomes in their degree programs. This handbook begins by providing basic information related to

(1) Concept related to assessment
(2) Course-level outcomes;
(3) Program-level outcomes;
(4) Assessing course and program level outcome
(5) Ways assessment data can or should be used to make improvements to degree programs.

# Contents

# 1. Institute Vision, Mission and Objectives

## VISION

"To satisfy the aspirations of the youth force, who wants to lead the nation towards prosperity through techno-economic development."

## Mission:

"To provide, nurture and maintain an environment of high academic excellence, research and entrepreneurship for all aspiring students, which will prepare them to face global challenges maintaining high ethical and moral standards".

## OBJECTIVES:

1. To provide quality education to students and nurture them for a professional career.
2. To increase the number of students progressing in higher education and entrepreneurship.
3. To make the students engaged in lifelong learning for accepting socio-economic responsibilities.
4. To promote students for research and adopting recent trends in technology among all disciplines.
5. To enhance the proficiency and excellence of teachers

## QUALITYPOLICY

We, at Bhivarabai Sawant College of Engineering and Research, are committed to maximize student's satisfaction through improved performance by imparting value based quality education.

## PROGRAM OUTCOMES

**PO 1**: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

**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.

**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.

**PO 4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO 5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

**PO 6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO 7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO 8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

**PO 9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

**PO11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO 12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# 2. Basic Terminology related to Assessment

## BASIC TERMINOLOGY

a. **Assessment-**Assessment is the systematic and ongoing method of gathering, analyzing and using information from measured outcomes to improve student learning.

b. **Assessment Method** - this term refers to any technique or activity that is used to investigate what students are learning or how well they are learning.

c. **Assessment Plan** – the proposed methods and timeline for assessment-related activities in a given course (e.g., when are you going to check what/how well the students are learning and how are you going to do that?).

d. **Course-Level Assessment** – this type of assessment focuses on what students are learning in a certain course within a program. Course-level assessment can focus on either a single section of a course or all sections of the same course. Course-level assessment data can be used as one source of information for program level assessment.

e. **Program Assessment-**When developing and implementing assessment strategies, academic units should have at least one of three purposes in mind: to improve, to inform, and/or to prove. The results from an assessment process should provide information that can be used to determine whether or not program outcomes are being achieved and how the programs can be improved. An assessment process should also be designed to inform departmental faculty and other decision-makers about relevant issues that can impact the program and student learning.

f. **Learning Outcome** - what the program faculty intend students to be able to know, do, or think upon completion of a degree program (synonyms for "program outcome" include learning outcome, learning outcome statement, exemplary educational outcomes, and expected learning outcome).

g. **Direct Assessment Method** - direct measures of student learning require students to display their actual knowledge and skills (rather than report what they think their knowledge and skills are). Examples of direct assessment methods include objective tests, essays, presentations, and classroom assignments.

h. **Indirect Assessment Method** – indirect assessment asks students to reflect on their learning rather than to demonstrate it. Examples include external reviewers, course end survey, student exit surveys, exit interviews, alumni surveys, employer surveys, etc.

i. **Formative Assessment** – assessment that occurs during a learning experience. This type of assessment allows faculty and administrators to make adjustments to the learning experience to increase student learning. Examples include midterm exams in the middle of a course, focus groups at the midpoint in a degree program, etc.

j. **Summative Assessment** – assessment that occurs at the end of a course completion (e.g., a comprehensive exam at the end of a semester etc.).

k. **Rubric** - a scoring and instruction tool used to assess student performance using a task-specific range or set of criteria. To measure student performance against this pre-determined set of criteria, a rubric contains the essential criteria for the task and levels of performance (i.e., from poor to excellent) for each criterion.

l. **Target (criterion):** Desired level of student performance on a particular learning outcome, stated explicitly in an assessment report, and set before assessment of course or program learning outcomes is conducted.

# WHY ASSESS?

Assessment can facilitate improvement through variety of venues. When faculty members are directly considering what worked well and what didn't, and involved in the development, implementation, and using those observations and impressions to make analysis of assessment activities, and umber of specific changes in your curriculum.

**Who is responsible for assessment?**

Assessment is not the sole responsibility of any one faculty member or administrator. The best assessment plans include a variety of professionals from various walks of life. Assessment is the responsibility of the management, faculty, and department. Program-level assessment is the responsibility of all of the faculty, administrators, and university for any given degree program.

**Purposes of program assessment**

The four main purposes of program assessment are:

**To improve** – the assessment process should provide feedback to determine how the program can be improved.

**To inform** – the assessment process should inform faculty and other decision makers of the contributions and impact of the program.

**To prove** – the assessment process should encapsulate and demonstrate to students, faculty, staff and outsiders what the program is accomplishing.

**To support** – the assessment process should provide support for institute decision-making activities such as program review and strategic planning, as well as external accountability activities such as accreditation.

**What are the steps to effective program assessment?**

Ultimately, the purpose of program assessment approach to respond to departmental goals and timelines, taking into account internal expectations, external requirements, or both. In general, however, department will complete the following steps to develop an effective program assessment plan: Checklist to better learning:

- Agree on your mission
- Create goals for program outcomes and processes
- Identify related activities for each goal
- Brain storm appropriate measures
- Evaluate and select measures
- Identify appropriate assessment methods
- Develop a plan for collecting data
- Prioritize goals
- Set time line, milestones
- Implement assessment plan
- Use data to improve processes
- Communicate results

# 3. Administrative Setup for Assessment Implementation

**The administrative system** for implementation of Assessment consists of coordinators and committees. There are three committees responsible for effective implementation which helps in ensuring the achievements of the PEOs/POs/PSOs.

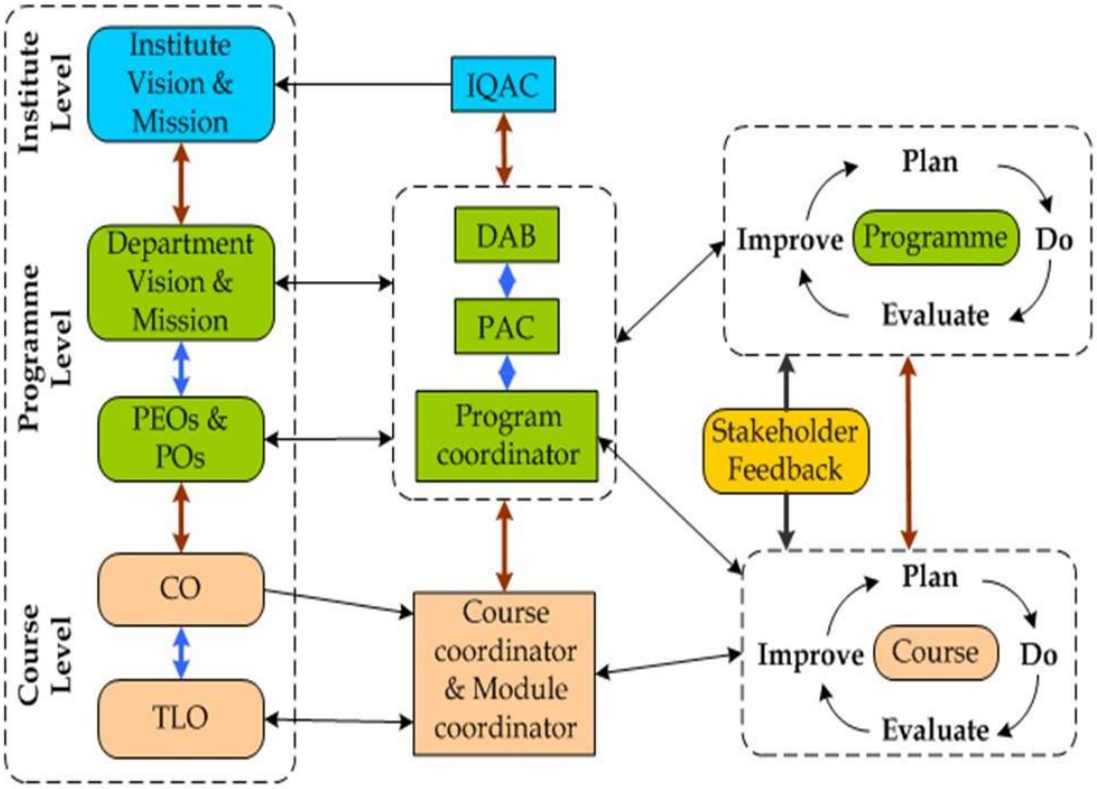



**Fig3.1 Administrative Setup**

## Internal Quality Assurance Cell (IQAC)

**Chairman:-Principal**

## Members

1. Head of Departments
2. NBA Coordinator/NBA Program Coordinators
3. Management representative
4. Student representative

## Functions of IQAC

1. Formulate Vision and Mission of the institute.
2. Approves Vision, Mission and PEOs of departments
3. Approval to necessary requirements for implementation of OBE system
4. Proposes necessary changes for improvements.
5. Act as a guiding and monitoring body for all departments committees and teams.

## Departmental Advisory Board (DAB)

DAB is basic constituent of the academic system

- The composition of the DAB:

i. **Chairman:** Head of the concerned department

ii. **Members:**

1. **Member secretary:** Program NBA Coordinator:
2. **Internal members:** Two senior faculty members of department.
3. **Industry representative:** One representative from industry/corporate sector/allied area relating to placement.
4. **Module coordinators**
5. **Course coordinators**
6. **One academician outside college.**
7. **One meritorious alumnus.**
8. **One parent.**
9. **One student.**

The term of the nominated members shall be two years. Principal shall decide the schedule for meeting of the DAB for different departments. The meeting may be scheduled as and when necessary, but at least once a year.

- **<u>Functions of DAB</u>**

1. Drafting of Vision, Mission of department
2. Drafting of PEOs, Formulation of POs/PSOs
3. Defines current and future issues related to programme.
4. Develop/recommends new or revised PEOs/PSOs
5. Recommends the proposals/requirements for effective implementation of OBE

6. Define various assessment tools for measuring outcomes
7. Evaluates the attainment of PEOs, POs/PSOs and proposes necessary improvements

## Program Assessment Committee (PAC)

**i.** Chair: Programme Coordinator

**ii.** Members:

1. Module coordinators
2. Faculty representatives

- **Functions of PAC**

1. Evaluates and monitors the attainment of POs/PSOs
2. Proposes necessary changes for continuous improvements.
3. Preparation of periodic reports on programme related activities, status reports for management and key stakeholders.
4. Faculty motivation: Attend/organize workshop/seminar/FDP, paper publication, development of models/lab.
5. Student motivation: Attend/participate tech competitions, paper presentation, mini projects/models, social/cultural events, skill development programs.
6. Conduct surveys, interaction with faculty, coordinators and other stakeholders
7. Planning of co-curricular activities for attainment of POs/PSOs

## Programme Coordinator:

The duties, responsibilities and regulations of coordinators are as follows:

i) Schedules programme work in accordance with PEOs and POs/PSOs.
ii) Oversees daily operations and coordinate activities of programme interrelated with activities of other programme to ensure optimum efficiency and compliance with appropriate policies and specifications given by HOD.
iii) Monitor and reviews activities of each year in the programme independently with course coordinators.
iv) Interacts with key stakeholders, student, faculty, HOD and employers.

v) Conduct and interprets various surveys require to assess PEOs and POs/ PSOs.

## Focus Group (FG)

**Chair:** Module Coordinator

**Members:**

1. Course coordinators.
2. Programme coordinator.
3. Student representative.
4. Industry representative.
5. Alumni representative

❖ **Functions of Focus Group (FG)**

1. Verification and approval of curriculum gaps and content beyond syllabi
2. Methodology and assessment tools to bridge the gaps
3. Approval to co-curricular activities
4. Evaluates the attainment of POs/PSOs and COs

## Module Committee (MC)

i. Chair: Module Coordinator
ii. Members: Course coordinators

❖ **Functions of Module Committee (MC)**

1. Formation of Cos and TLOs
2. Formulation of curriculum gap and content beyond syllabi
3. Semester planning for course delivery, design contest, workshop, expert lectures, site visits, mini projects
4. Evaluates and monitors the attainment of Cos, TLOs
5. Proposes necessary changes for continuous improvements.
6. Preparation of periodic reports on course related activities, status reports for management and key stakeholders.
7. Student motivation: Attend/participate tech competitions, paper presentation, mini projects/models, social/cultural events, skill development programs.

**Module Coordinator:**

The duties, responsibilities and regulations of coordinators are as follows:

i) Coordinate and supervise the faculty teaching the courses in the module
ii) Assessment of COs.
iii) Recommend and facilitates workshop/guest lectures/seminar/FDP to meet the COs.
iv) Analyze the attainment of Cos of a particular course and recommends programme coordinator to take appropriate action for improvements.
v) Interact with students, faculty, Programme Coordinator and Headof Department to determine priorities and policies for improvements.

**Course Coordinator:**

The duties, responsibilities and regulations of coordinators are as follows:

vi) Plan, implement, monitor and review Topic Learning Outcomes (TLOs) and Course Outcomes (COs).
vii) Evaluation of COs.
viii) Suggest improvements based on attainment of COs.

**3.6.3. Course teacher**

**The functions and duties of course teacher are:**

**i.** Conduct classes as per the time table issued by the HOD and maintain all academic records (Attendance on moodle, Evaluation, Attainment) for that course.
**ii.** Prepare course delivery and evaluation plan for student performance and distribute to all the students within the first week of each semester.
**iii.** Display students' performance in attendance and evaluation as stipulated in the academic RRs.
**iv.** Report to the HOD on a periodic (monthly) basis, the potential cases of very poor academic performance as well as those of low attendance.

**v.** Submit Class Test Marks/Assignment/Teamwork marks to PAC as per the schedule in academic calendar.

**vi.** Document all academic records in the course book in a format specified by Dean IQAC and submit it for academic audit.

# 4. Framing Course Outcomes

## Course Outcomes (COs)

COs are statements indicating what a student can do after the successful completion of a course. Every Course leads to some Course Outcomes. Course Outcomes (COs) are typically defined by the SPPU and are closely aligned with the content covered in each unit of a course.

- It states both the substance of learning and how its attainment is to be demonstrated.
- It is a formal statement that articulate:– The knowledge, skills/abilities, and attributes we want our students to be able to demonstrate.

COs are specific statements that describe what students are expected to know, understand, and be able to do after completing each unit of a course. Each unit of a course is designed to address one or more COs, ensuring that the course as a whole achieves its intended learning objectives. The COs help in:

1. **Curriculum Mapping**: Ensuring that the course content is aligned with the learning outcomes.
2. **Assessment Design:** Defining the basis for creating assignments, quizzes, and exams that measure students' progress toward achieving the outcomes.
3. **Continuous Improvement:** Facilitating feedback loops for course development and pedagogical improvements.

## Writing effective learning outcome statements

Selection of Action Words for course Outcome Statements: When stating student learning outcomes, it is important to use verbs that describe exactly what the learner(s) will be able to know or do upon completion of the degree program.

Many degree programs want to incorporate words that reflect critical or higher-order thinking into their learning outcome statements. Bloom (1956) developed a taxonomy outlining the different types of thinking skills people use in the learning process.

## Bloom's Taxonomy

Benjamin Bloom was working along with a group of measurement specialists in early 1950s on the development of taxonomy of learning.

- In 1956, the group produced "Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain." (Bloom, Engelhart, Furst, Hill, & Krathwohl,1956). This became quite popular and was generally called "The Handbook."
- After a similar process of discussions involving several experts, a major revision was proposed in 2001. Anderson, Krathwohl et. al. (Eds): "A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives"

### A. Bloom's Taxonomy: Learning Domains

- Any given task tends to be generally dominant in one of the three psychological domains: cognitive, affective, or psychomotor.
- The cognitive domain deals with a person's ability to process and utilize information in a meaningful way.
- The affective domain relates to the attitudes and feelings that result from or influence the learning process.
- The psychomotor domain involves manipulative or physical skills.
- This classification is for focus and convenience; all the three dimensions are involved to varying degrees in all intended learning experiences and activities.

### B. Blooms Level:

**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.

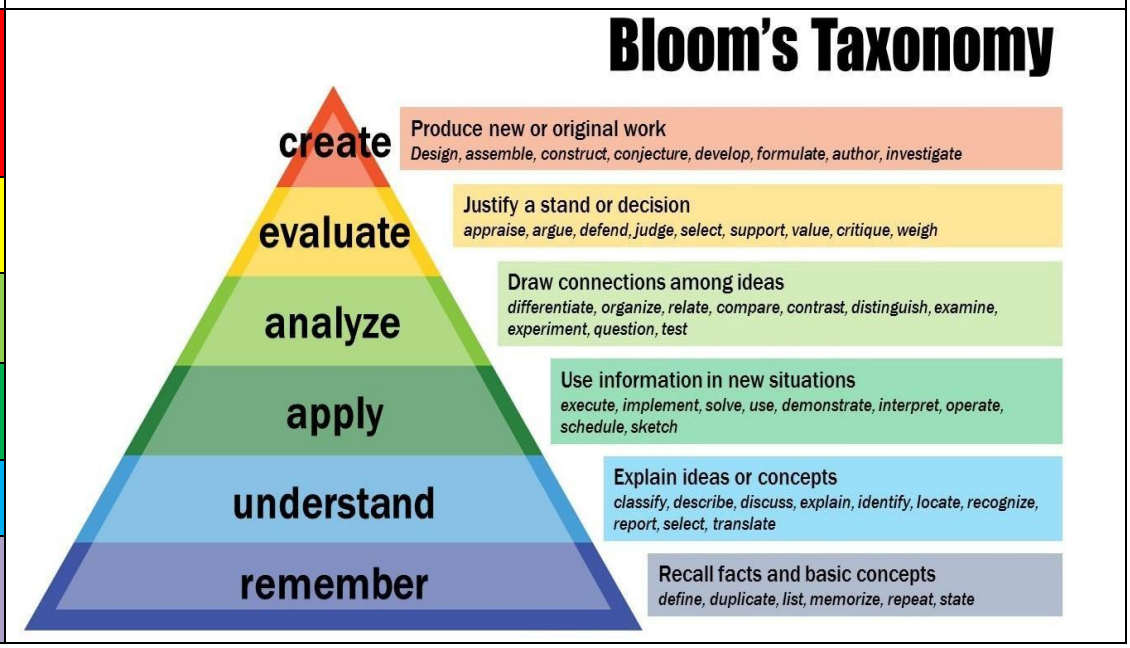
| Blooms levelno | BloomsTaxonomyterms |
|---|---|
| 6<br>5<br>4<br>3<br>2<br>1 |  |

Fig 4.1Bloom's Taxonomy

**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.

**c. List of action words related to critical thinking skills**

| *Remember* | *Understand* | *Apply* | *Analyze* | *Evaluate* | *Create* |
|---|---|---|---|---|---|
| *Describe*<br>*Define*<br>*Label, List*<br>*Locate*<br>*Match*<br>*Name ,Omit*<br>*Recite, Select*<br>*State ,Count*<br>*Draw Outline* | *Classify*<br>*Defend*<br>*Demonstrate*<br>*Distinguish*<br>*Explain*<br>*Express*<br>*Extend*<br>*Give Examples*<br>*Summarize*<br>*Discuss*<br>*Estimate* | *Choose*<br>*Explain*<br>*Generalize*<br>*Judge*<br>*Organize*<br>*Prepare*<br>*Produce*<br>*Select*<br>*Show*<br>*Solve*<br>*Classify*<br>*Complete*<br>*Compute*<br>*Discover* | *Categorize*<br>*Classify*<br>*Compare*<br>*Differentiate*<br>*Distinguish*<br>*Identify*<br>*Infer*<br>*Select*<br>*Survey*<br>*Arrange*<br>*Breakdown*<br>*Combine*<br>*Detect*<br>*Diagram*<br>*Discriminate*<br>*Illustrate* | *Appraise*<br>*Judge*<br>*Criticize*<br>*Compare*<br>*Assess*<br>*Conclude*<br>*Contrast*<br>*Critique*<br>*Determin e Grade*<br>*Justify*<br>*Measure*<br>*Rank*<br>*Rate*<br>*Support*<br>*Test* | *Combine*<br>*Compose*<br>*Construct*<br>*Design*<br>*Develop*<br>*Formulate*<br>*Hypothesize*<br>*Invent* |

## Structure of a CO statement

- **Action:** Represents a cognitive/ affective/ psychomotor activity the learner should perform. Action is indicated by an action verb, occasionally two, representing the concerned cognitive processes.
- **Knowledge**: Represents the specific knowledge from any one or more of the eight knowledge Categories
- **Condition**: Represents the process the learner is expected to follow or the condition under which to perform the action (This is an optional element of CO)
- **Criteria:** Represent the parameters that characterize the acceptability levels of performing the action (This is an optional element of CO)

## How to write course outcome statements

- **Write in the future tense**–'by the end of this course, students will be able to…'
- Don't try to use outcomes to replace your syllabus – identify the most important things you want the students to learn, and try keep the **number of outcomes to between 4 and 6.**

- Make sure that your **outcomes are achievable and assessable** – think about how you might assess the outcomes as you write them and excise any which are vague, unclear or un-assessable. (Avoid verbs such as "understand," "appreciate," and "value," which are not observable or measurable.)
- Try to use language that students will understand – try to avoid jargon and abbreviations. It should be limited to one verb .
- **Include process as well as product** – try not to make the outcome match the product, rather use the outcome to show what process you expect students to undertake.
- Write at the **appropriate cognitive level** for the course
- Have a balance of **different types of outcome.**

## Sample COs Course: CAD CAM AUTOMATION

After the completion of the course, students will be able to

| | |
|---|---|
| CO312.1 | Apply homogeneous transformation matrix for geometrical transformations of 2D CAD entities for basic geometric transformations. |
| CO312.2 | Use analytical and synthetic curves and surfaces in part modeling. |
| CO312.3 | Do real times analysis of simple mechanical elements like beams, trusses, etc. and comment on safety of engineering components using analysis software. |
| CO312.4 | Generate CNC program for Turning / Milling and generate tool path using CAM software. |
| CO312.5 | Demonstrate understanding of various rapid manufacturing techniques and develop competency in designing and developing products using rapid manufacturing technology. |
| CO312.6 | Understand the robot systems and their applications in manufacturing industries. |

# 5.Mapping of CO with PO and PSO

## Correlation of CO with PO, PEO

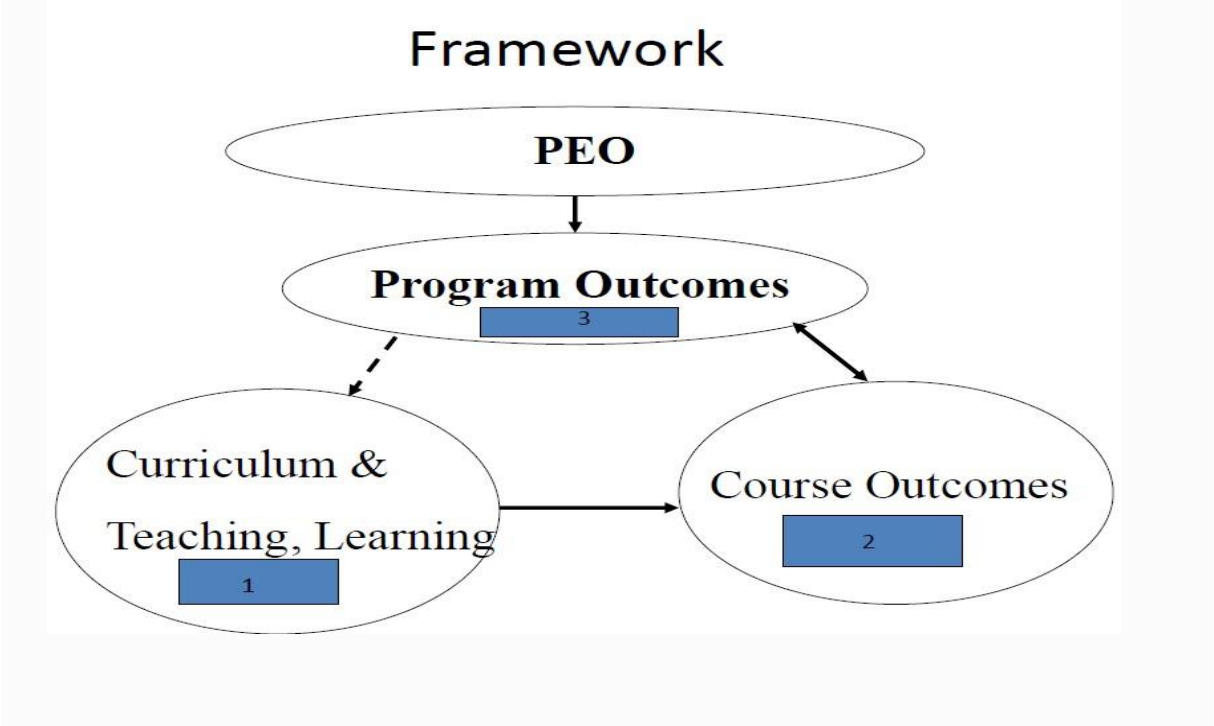



FIG 5.1 Correlation of CO with PO, PEO

## 5.2. Steps involved in CO-PO Mapping.

**1. CO Formulation process:** For each course, subject teacher assign appropriate blooms level to each Course Outcome defined by SPPU for every course. The CO statements are defined by SPPU considering the course content covered in each module of a course. For every course there may be 5 or 6 COs.

**2. CO mapping with PO and PSO**: All the courses together must cover all the POs (and PSOs). For a course, map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are:

- **"1"**–Slight(Low) Correlation
- **"2"**–Moderate(Medium)Correlation
- **"3"**–Substantial(High)Correlation
- **"4"**indicates there is no correlation.

### 3. A sample CO-PO Course Articulation matrix

Table5.1CO-POmatrix

| CLASS | COURSE/ SUBJECT | COURSE OUTCOMES | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| TE | XYZ | CO1 | 2 | 1 | 1 | - | 1 | 2 | - | - | 1 | 1 | - | 2 | 1 | - | - |
| | | CO2 | 3 | 2 | 2 | - | 1 | 1 | - | - | 1 | 1 | - | 1 | 1 | - | - |
| | | CO3 | 2 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 | 1 | - | - |
| | | CO4 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | 2 | - | 2 | 1 | - | - |
| | | CO5 | 2 | 1 | 1 | - | - | 1 | - | - | 1 | 1 | - | 1 | 1 | - | - |
| | | CO6 | 2 | 2 | 2 | - | 1 | 1 | - | - | - | - | - | 1 | 1 | - | - |
| | | AVG | 2.33 | 1.67 | 1.67 | 1.00 | 1.00 | 1.33 | - | - | 1.20 | 1.40 | - | 1.50 | 1.00 | - | - |

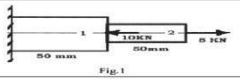
- It is necessary to determine the level (mapping strength) at which a particular PO/PSO is addressed by the course.
- Subject teacher can estimate the mapping strengths between specific COs and POs/PSOs based on subjective perception, taking into account the expected cognitive level, as well as the nature of the course content. Such estimated values can be entered into the matrix.

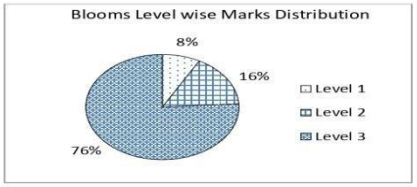
### 4. Mapping of assessment with CO,PO and PSO

The course teacher prepare list of test paper ,assignments .All questions are mapped with appropriate Blooms level, CO, PO,PSO. The analysis of distribution of cognitive level is done. The assessment purpose is to measure the stated course outcome of student; hence assessment tool is selected properly and aligned with CO.

**JSPM's Jayawantrao Sawant College of Engineering Hadapsar, Pune**
**Department of Mechanical Engineering**
**MID TERM TEST**
[BE-MECH], Sem-I (AY: 2019-20)
**(Sub: CAD/CAM AND AUTOMATION)**

Date: 12/08/2019 [Duration: 2 hours]
Time: 8:30 to 10:30 am Maximum Marks: 50

| Q. No. | Description | Marks | Attainment of | | | |
|---|---|---|---|---|---|---|
| | | | CO | PO | PSO | BL |
| *1 a)* | An object is to be rotated about point A (-10,-10) by 90° in counterclockwise direction. Calculate concatenated (CT) transformation matrix. | 4 | 1 | 1,2 | 1 | 3 |
| *1b)* | A triangle ABC having coordinate point A (10, 10), B (40, 10) and C (40, 30). Perform following operation in sequence:<br>1) Mirrored about line y=x and<br>2) Rotate by $30^0$ about point A.<br>Write concatenated transformation matrix and new coordinates of the rectangle. | 8 | 1 | 1,2 | 1 | 3 |
| *1 c)* | Explain in detail Orthographic Transformations and Isometric Transformations from the perspectives of Computer aided Design | 4 | 1 | 1,2 | 1 | 2 |
| *2 a)* | Given two lines $L_1$ and $L_2$, end point for $L_1$ are $P_1$ (1, 2, 7) and $P_2$ (5, 6, 1) end points for $L_2$ are $P_3$ (7, 3, 4) and $P_4$ (3, 9, 10).<br>Determine:<br>1) Parametric equations of lines.<br>2) Unit vectors in the directions of lines.<br>3) Are the two lines parallel/ perpendicular? | 6 | 2 | 1,2 | 1 | 3 |
| *2 b)* | Find the points on the Hermite Cubic Spline curve at the value of u = 0, 0.2, 0.4, 0.6, 0.8 and 1 having the end points $P_0$ (1, 1) and $P_1$ (7, 4). The tangent vector for end $P_0$ (5, 6) and $P_1$ (10, 7). | 6 | 2 | 1,2 | 1 | 3 |
| *2 c)* | Draw neat sketch a constructive solid geometry (CSG) technique of modeling. State its two main advantages. | 4 | 2 | 1,2 | 1 | 1 |
| *3 a)* | Find stresses in step bar due to forces 10KN and 5 KN. Modulus of elasticity: $E_1$ = 200 GPa & $E_2$=70 GPa, Area: $A_1$ = 150mm$^2$ & $A_2$=100 mm$^2$   Fig.1 | 10 | 3 | 1,2 | 1 | 3 |
| *3 b)* | Explain linear shape functions in FEM. | 4 | 3 | 1 | 1 | 2 |
| *3 c)* | Derive Element Stiffness Matrix for 1-D by any method. | 4 | 3 | 1,2 | 1 | 3 |





**CO – Course Outcomes**
**PO – Program Outcomes**
**PSO – Program Specific Outcomes**
**BL – Bloom's Taxonomy Levels**
**(1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)**

Fig5.2 Sample Question Paper

# 6. Assessment Tools and Evaluation Process

## 6.1 Assessment methods

- Assessment methods are tools and techniques used to determine the extent to which the stated learning outcomes are achieved. A variety of methods, qualitative and quantitative, direct and indirect, should be used.

## 6. 2 Assessment tools

- Tools used for course assessment are Direct Assessment Tools and Indirect Assessment Tools.

| Examples of Direct Assessment Methods: | Examples of Indirect Assessment Methods: |
|---|---|
| • Comprehensive exams<br>• Performance assessment<br>• Writing proficiency exams<br>• Field Achievement Tests<br>• GRE subject exams<br>• Certification exams,<br>• Internal tests<br>• Mini project<br>• Portfolio evaluation<br>• Internship evaluations<br>• Grading with scoring rubrics* | • Peer institutions comparison<br>• Job placement<br>• Employer surveys<br>• Performance in institute<br>• Student graduation/retention rates Exit interviews<br>• Focus group discussions<br>• Alumni surveys Tracking of alumni awards, achievements (national, state, international, etc.)<br>• Curriculum/syllabus analysis |

### Sample Assessment Methods used at department

1. Written surveys and questionnaires-Asking individuals to share their perceptions about a particular area of interest—e.g., their own or others' skills/attitudes/behavior, or program/course qualities and attributes.

2. Exit and other interviews - Asking individuals to share their perceptions about a particular area, of interest—e.g., their own skills/attitudes, skills and attitudes of others, or program qualities— in a face-to-face dialog with an interviewer.

3. Commercial, norm-referenced, standardized examinations - Commercially developed examinations, generally group administered, mostly multiple choices, "objective" tests, usually purchased from a private vendor.

4. Locally developed assessments - Objective or subjective designed by local staff/faculty.

5. Focus groups - Guided discussion of a group of people who share certain characteristics related to the research or evaluation question, conducted by trained moderator.

6. Portfolios (collections of work samples usually compiled over time and rated using scoring rubrics).

7. Performance Appraisals - Systematic measurement of overt demonstration of acquired skills, generally, through direct observation in a "real world" situation—e.g., while student is working on internship or on project for client.

8. External Examiner - Using an expert in the field from outside your program— usually from a similar program at another institution —to conduct, evaluate, or supplement the assessment of students.

9. Oral examinations - Evaluation of student knowledge levels through a face-to-face dialogue between the student and the examiner—usually faculty.

## Setting Course Outcome Targets

There are ever always to set target level. Course coordinator can decide target in consultation with module coordinator. Following are few ways to set target.

a. To set the target level average mark criteria is used. Average marks of last three exams can be taken into consideration and it should be kept as target average marks.

b. If average marks of last exams are not available then current average marks can also be considered as target level.

c. Target level can be different for each assessment method (e.g. Internal assessment: assignment1, assignment2, class test1, class test2 etc. External assessment: End Semester exam/university exam, Practical external exam)

d. Same target can be identified for all the Cos of a course.

## Definition of Attainment

Attainment can be defined as what percentage of students has above set target marks. There are many ways to set attainment level. Course coordinator can select the attainment criterion for a given course. E.g.

- **Attainment Level 3**: 60% of students score more than 60% marks out of the maximum relevant marks.
- **Attainment Level 2**: 50% of students score more than 60% marks out of the maximum relevant marks.
- **Attainment Level 1**: 40% of students score more than 60% marks out of the maximum relevant marks.

## Continuous Evaluation

To ensure effective academic progress and to decide corrective actions, continuous internal evaluation is essential. Internal assessment broadly includes theory/objective exam and student activity

1. Theory exam includes test, assignments and MCQs. Each of the questions is mapped with CO and Bloom's level. The proper attention is given to ensure the weightage for each CO
2. Performance assessment in lab, projects and students' activities are done through well-defined performance rubric .

| Sr. no. | Method | Tools for Assessment | Type of assessment | Assessment Cycle |
|---|---|---|---|---|
| 1 | Direct | Internal class Tests | internal | Two class tests per semester |
| 2 | Direct | Assignments/Tutorial | internal | Assignments(as applicable) |
| 3 | Direct | Practical evaluation | internal | Every practical batch per practical per student |
| 4 | Direct | Seminar/project evaluation | internal | Once per semester |
| 5 | Direct | University Exams | External | Once per semester |
| 6 | Indirect | Course Exit Survey | internal | At the end of Semester |

A. **Continuous assessment in the laboratory**

Performance based internal assessment of students is carried out on each assignment during the regular Practical Session, lab reports are also written and evaluated on regular basis.

**Continuous Assessment of Experiment:**

- Mapping of each experiments with one or more CO's, POs and PSOs
- Elaboration of aim and scope of the each Lab assignment.
- Building of performance parameter along with rubrics.
- Implementation/conduction of assignment along with write-ups and accordingly grading of performance parameter for individual students.
- The assessed marks are included in CO attainment calculation for respective lab in respective theory subject

**Fig 6.1 describes the process adopted for internal evaluation and articulated as below:**

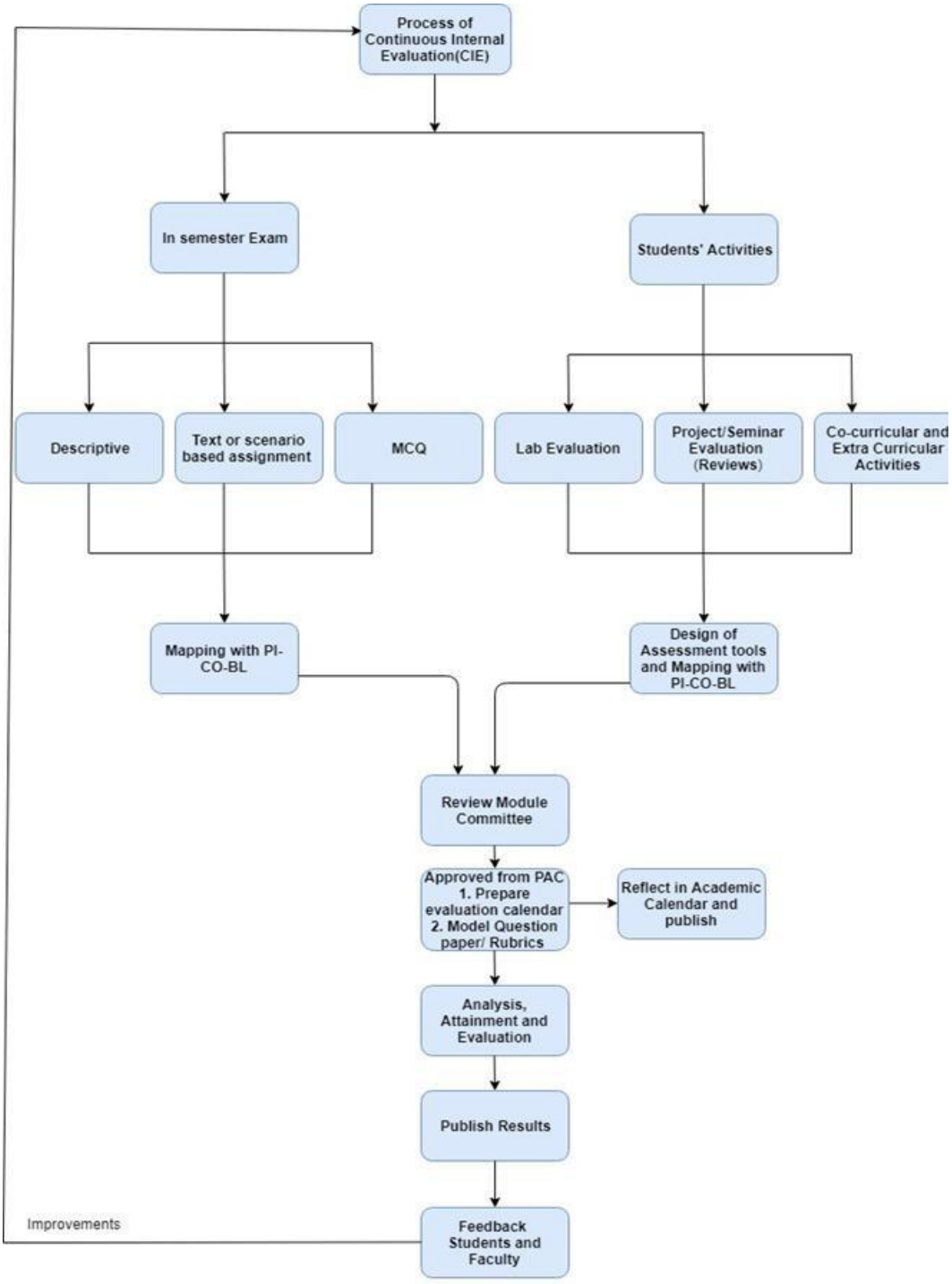



**Fig 6.1 Process for Internal Evaluation**

## Sample of Assessment Tools used to assess course outcomes with target and weightage

| Course Outcome | Assessment Tools | Set Target | Weightage | Attainment levels |
|---|---|---|---|---|
| C202.1<br>C202.2<br>C202.3<br>C202.4<br>C202.5<br>C202.6 | Test | 60% | 30% | No of students actively target= y =42<br>Total No of students=N=47<br>CO attainment = (y/N) * 100=42/47*100=89.36<br>Then attainment levels are<br>0<AL0<40<br>40<=AL1<50<br>50<=AL2<60<br>60<=AL3<=100 |
| | Practical Experiment | 60% | Rubric score 30% | |
| | Assignment | 60% | 30% | |
| | Course end survey | 60% | 10% | |

## Targets and attainment levels

| Assessment Tool type | Outcome attainment |
|---|---|
| Internal Assessment Tools | Target: 60% of max allotted marks.<br>Authority: Course Coordinator |
| External Assessment Tools | Target: University exam-60%of max allotted Marks<br>Authority: Program Assessment Committee |
| Attainment levels | AL=%age no of students achieving target<br>• AL0=0-39%<br>• AL1=40-50%<br>• AL2=51-60%<br>• AL3=61-100% |

## Overall Process of Internal Assessment is as shown in flowchart:

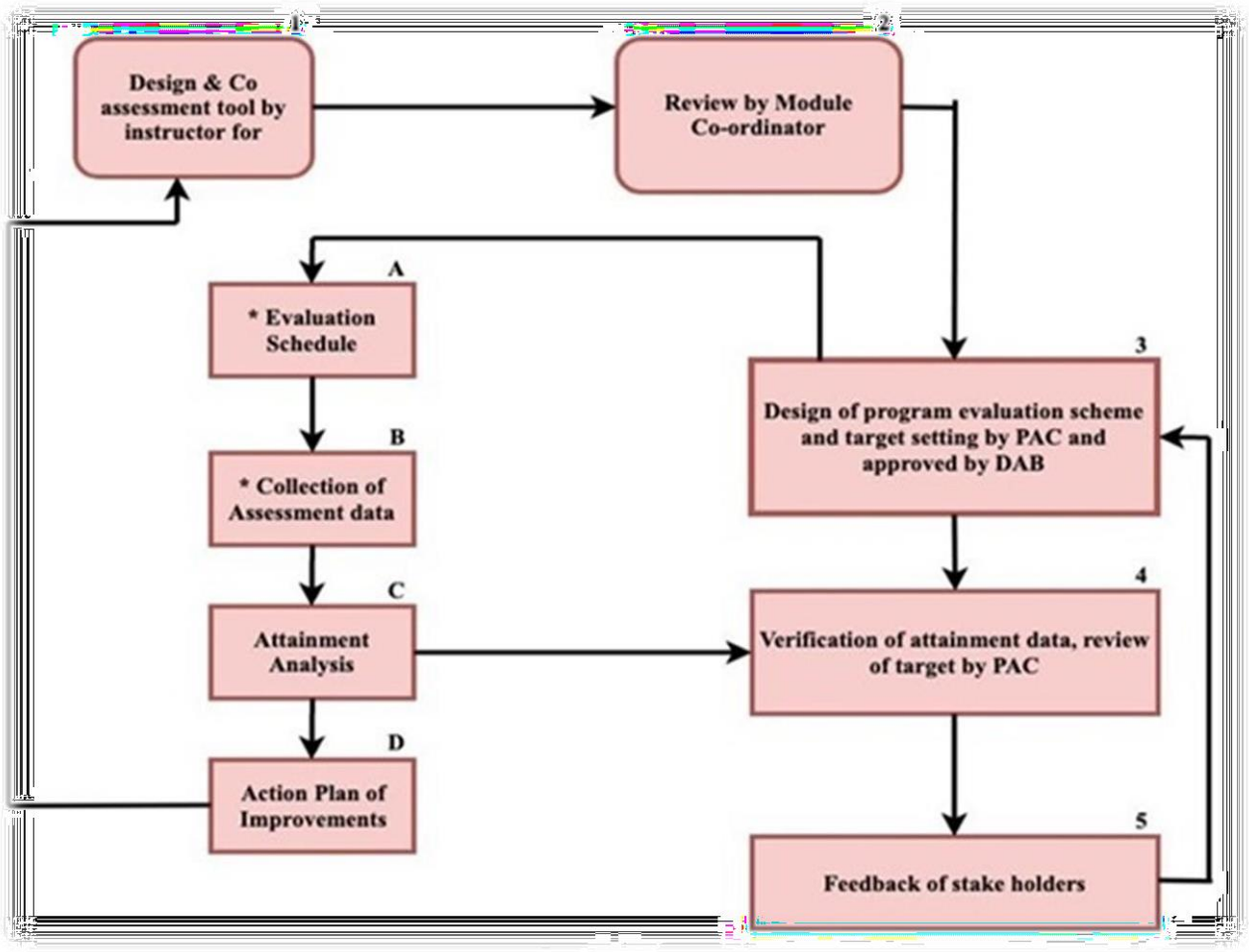



**Fig 6.2 Steps involved in Internal Assessment**

# 7. CO Attainment Process

## 7.1 CO Assessment Plan (Direct-Internal Assessment):

For each course, assessment plan is prepared which includes mark distribution, assessment tool for each course outcome.

**Sample Assessment Plan**

| CO Assessment Process: Direct tools-Graded and Performance Rubrics (Internal) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Unit** | **Marks allocation** | **Direct Graded** | | | | | | | | **Direct Non graded** | | | | **Share of Each CO** | |
| | | | **Internal Test** | | **Objective Tests** | | | | | | **Lab-Work (Experiments)and Student Activities (Assesses by Performance Rubrics)** | | | | | |
| | | | IT1(25) | IT2(25) | OT1(25) | OT2(50) | OT3 | OT4 | OT5 | OT6 | EXPT | Poster Presentation | Survey | Programming | Marks | Percentage |
| C308.1 | I | 18 | 18 | | 15 | | | | | | 60 | | | | 93 | 23.25 |
| C308.2 | II | 16 | 16 | | | 15 | | | | | 30 | | | | 61 | 15.25 |
| C308.3 | III | 16 | 16 | | | | 15 | | | | 30 | | | | 61 | 15.25 |
| C308.4 | IV | 16 | | 16 | | | | 15 | | | | 30 | | | 61 | 15.25 |
| C308.5 | V | 16 | | 16 | | | | | 15 | | | | 30 | | 61 | 15.25 |
| C308.6 | VI | 18 | | 18 | | | | | | 15 | | | | 30 | 63 | 15.75 |
| **Total** | | | **50** | **50** | **15** | **15** | **15** | **15** | **15** | **15** | **120** | **30** | **30** | **30** | **400** | **100** |

IT=Internal Test OT=Objective Test

## 7.2 Overall process to measure CO attainment

- Attainment of Cos can be measured **directly** and **indirectly**
- Direct attainment of COs can be determined from the performances of students in all the relevant assessment.
- Indirect attainment of Cos can be determined from the course exit survey.
- The exit survey form should permit receiving feedback from students on all the COs.
- Computation of indirect attainment of COs is based on the student refection. Hence, the percentage weightage to indirect attainment kept at a low value, say 10%.

## 7.3 Stepwise CO attainment

### 7.3.1 Direct CO Attainment

Direct attainment of Cos is determined from the performances of students in Continuous Internal Evaluation (CIE) and University Exam(UE)

- The proportional weightages internal assessment contributes 30% and university assessment contributes 70%.
- Direct attainment of a specific COs is determined from the performances of students to all the assessment items related to that particular CO. Hence, every assessment item needs to be tagged with the relevant CO.
- Also, we need data about performance of students in all assessment.

### 7.3.2 Direct CO attainment from CIE

- Continuous Internal Evaluation(CIE)is conducted and evaluated by the Department itself
- Course teacher has access to question-wise marks in all assessment in CIE.
- As all questions are tagged with relevant COs, the performances of students with respect to each CO can be recorded.

**The process of CO attainment is articulated in figure**

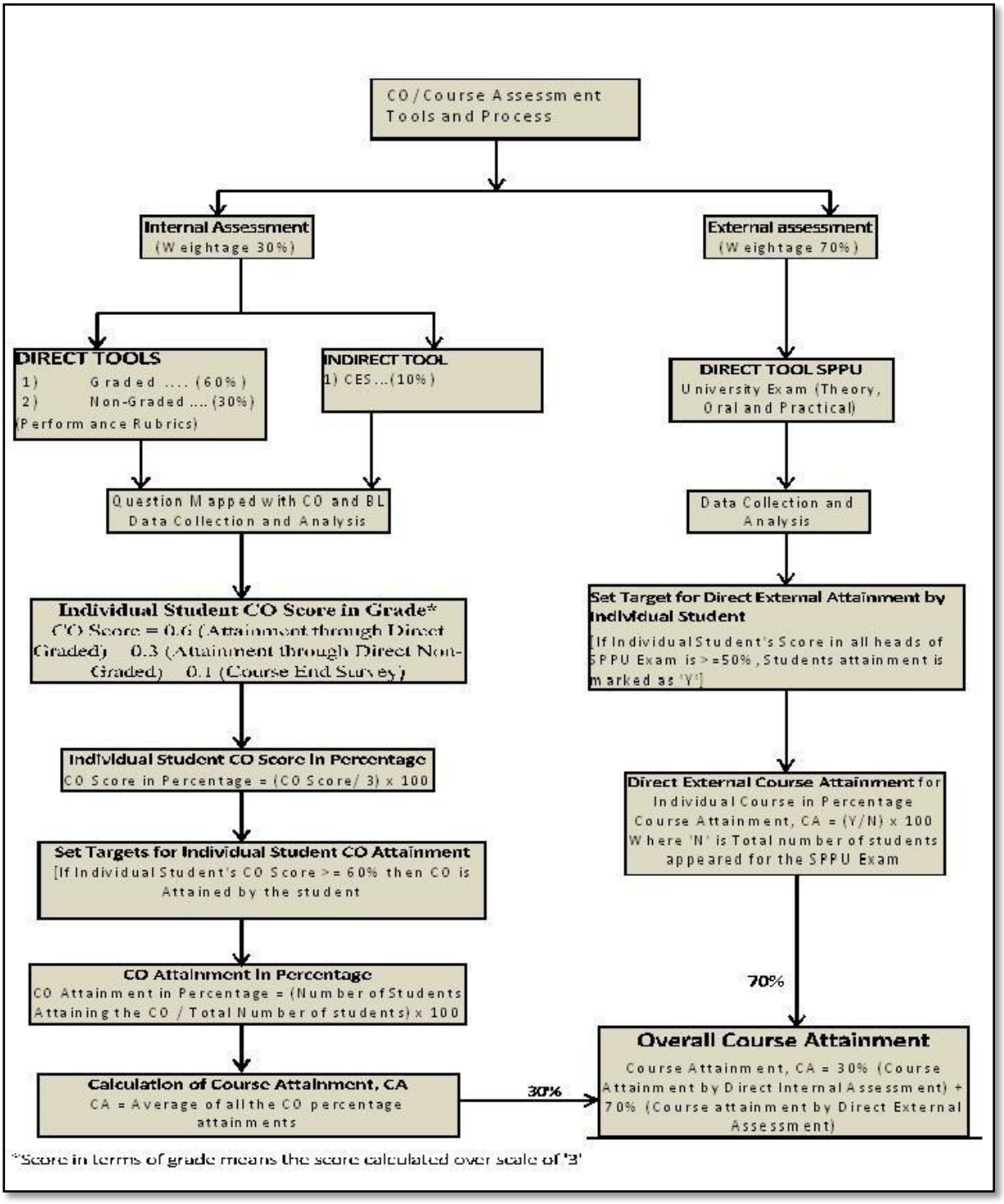



Fig7.1COAttainmentFlowchart

Table 7.1: Attainment of CO by Direct-Internal Assessment Method

| Course:-Design Of Machine Elements-II(DME-II) (C308)[Semester-IIAY2018-19] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C308.1Attainment | | | | | | | | | | | | |
| OverallScoreOfTheStudentOverScaleOf'3', (D)=0.6 X(A)+ 0.3 X (B)+ 0.1 X(C)&%Score Of The Student, (E)= (D)/3 X100 | | | | | | | | | | | | |
| | Direct-Graded | | | | | Direct Non-Graded | | | CES | Attainment | | |
| Max Marks | 18 | 15 | **33** | **Percentage Direct-Graded Marks Obtained By The Student (%)** | **Total Direct-Graded Marks Converted To Scale Of '3'** | **(Assessed By Performance Rubrics)** | | **Average Of Direct Non-Graded Marks (ScaleOf3)** | **Course End Survey** | **Total Score Of The Student** | | **Student's Percent Score Cross The Threshold* Value** |
| Name Of The Student | MT(Q1) | OTQ1 | **Total Marks Obtained** | | | **Lab-Work/ Experiment** | **Student Activity** | | | **Over The Scale Of'3'** | **%Score Of The Student** | |
| | | | | | (A) | | | (B) | (C) | (D) | (E) | |
| Angawane Pranil Sunil | 4 | 11 | 15 | 45% | 1.36 | 1.60 | Na | 1.60 | 3.00 | 1.60 | 53.27 | No |
| Bambal Pratik Anil | 12 | 12 | 24 | 73% | 2.18 | 2.20 | Na | 2.20 | 3.00 | 2.27 | 75.64 | Yes |
| Bhamre Sumit Bhaskar | 14 | 10 | 24 | 73% | 2.18 | 2.20 | Na | 2.20 | 3.00 | 2.27 | 75.64 | Yes |
| : | : | : | : | : | : | : | : | : | : | : | : | : |
| : | : | : | : | : | : | : | : | : | : | : | : | : |
| Wedhane Jayesh Nandkumar | 14 | 4 | 18 | 55% | 1.64 | 2.40 | Na | 2.40 | 3.00 | 2.00 | 66.73 | Yes |
| Yadav Aniket Pradeep | 00 | 00 | 00 | 00% | 0.00 | 1.00 | Na | 1.00 | 0.00 | 0.30 | 10.00 | No |
| Zende Sourabh Dipak | 14 | 8 | 22 | 67% | 2.00 | 2.20 | Na | 2.20 | 3.00 | 2.16 | 72.00 | Yes |

MT=Mid-term test, OT=Online Test, AS=Assignment, PR=Practical (Lab experiment)
CES=Course end survey

## Attainment of all Cos

| COURSE OUTCOMES | Percentage | Attainment |
|---|---|---|
| C308.1 | 54.79 | 2 |
| C308.2 | 49.32 | 1 |
| C308.3 | 53.42 | 2 |
| C308.4 | 57.53 | 2 |
| C308.5 | 45.21 | 1 |
| C308.6 | 50.68 | 2 |
| Average | 51.83 | 1.67 |

## Direct CO attainment from University exam

- External exam is conducted and evaluated by the University, so Departments get only total marks scored in exam.
- Departments have no access of individual CO performance. So average marks in university exam is considered as common attainment for all Cos.

## Course Attainment by Direct [External] Assessment Process

Percentage attainment of the course will be calculated as,

$$\%\text{attainment} = \frac{\text{(Number of Students Securing} \geq 50\%)}{\text{(Total number of students appearing for exam)}} * 100$$

| Roll No | Name of Student | SEMV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C308DME-II[302048]TEMECHSEM-IIAY 2018-19 | | | | | | | | Percentage marks of the student | Student's %Marks Cross the Threshold* (YES/NO) |
| | | Insem Exam | | Theory Exam | | Oral Exam | | Total Marks (Out of 125) | | | |
| | | Marks Obtained | Maximum Marks | Marks Obtained | Maximum Marks | Marks Obtained | Maximum Marks | Marks Obtained | Maximum Marks | | |
| | KADAM UDAJI ADITYA | 28 | 30 | 56 | 70 | 22 | 25 | 106 | 125 | 84.80 | YES |
| | DOMBALE NIKHIL NIVRUTTI | 15 | 30 | 46 | 70 | 20 | 25 | 81 | 125 | 64.80 | YES |
| | KONDE PRATIK HANUMANT | 22 | 30 | 29 | 70 | 18 | 25 | 69 | 125 | 55.20 | YES |
| : | : | : | : | : | : | : | : | : | : | : | : |
| | PAWAR HARSHAD UTTAM | 1 | 30 | 28 | 70 | AA | 25 | 29 | 125 | 23.20 | NO |
| | KULKARNI PRATHAMESH SHRIRAM | 10 | 30 | 21 | 70 | AA | 25 | 31 | 125 | 24.80 | NO |
| | BARI NACHIKET RAVINDRA | 18 | 30 | 42 | 70 | 13 | 25 | 73 | 125 | 58.40 | YES |
| | DESHMUKH MIKHIL ANIL | 0 | 30 | AA | 70 | AA | 25 | 0 | 125 | 0.00 | NO |
| | MORE SURAJ DATTATRAYA | 12 | 30 | 45 | 70 | 3 | 25 | 60 | 125 | 48.00 | NO |

| | |
|---|---|
| Total number of YES | Y=134 |
| Total number of students | N= 172 |
| % Attainment =(134/172)*100 | 77.90 |

Total marks as scored by each student for each course is calculated. Then percentage marks as scored by each student for a particular course is calculated and the students securing more than 50%*mark for that course (subject) are assumed to have attained that course (YES). The number of "YES" i.e. the number of Students attained the

course is counted and total number of students appearing for that exam is also counted and based on these two values, percentage attainment for that particular course(subject) is calculated. This percentage is treated as the attainment by direct-external assessment process. The same is depicted in table (50% is assumed as threshold value of direct-external assessment for each course/subject)

| YEAR | COURSE | COURSE OUTCOMES | Co Attainment (Internal) | SPPU Attainment (External) | Total Attainment | Attainment Level |
|---|---|---|---|---|---|---|
| BE | DOM-II | C308.1 | 54.79 | 77.90 | 66.345 | 3 |
| | | C308.2 | 49.32 | 77.90 | 63.61 | 3 |
| | | C308.3 | 53.42 | 77.90 | 65.66 | 3 |
| | | C308.4 | 57.53 | 77.90 | 67.715 | 3 |
| | | C308.5 | 45.21 | 77.90 | 61.555 | 3 |
| | | C308.6 | 50.68 | 77.90 | 64.29 | 3 |
| | | AVERAGE | 51.82 | 77.90 | 64.86 | 3 |

## Direct Attainment Computation of CO

(Weighted summation of direct-internal and direct-external percentage for calculating overall attainment percentage)

Once direct-internal and direct-external percentage attainment is known for all the courses of a particular semester of a particular academic year, assigning 30% weightage for direct-internal and 70% weightage for direct-external attainment percentage a weighted sum is calculated as overall percentage attainment for a particular course.

Overall direct attainment of a course/subject=30% of Direct Internal Percentage Attainment + 70% of Direct External Percentage Attainment

| YEAR | COURSE NAME | COURSE CODE | Internal | | External | | Total Attainment=( 0.3*internal attainment)+ (0.7*external attainment) | Attainment level |
|---|---|---|---|---|---|---|---|---|
| | | | Weightage30% | | Weightage70% | | | |
| | | | Actual% of internal CO Attainment | Weight | Students scored more than average marks in SPPU exam | Weight | | |
| BE | **DOM** | **XYZ** | **51.82** | **0.3** | **77.90** | **0.7** | **70.07** | 3 |

## Total CO Attainment:

Computation of Attainment of CO=0.9 x Direct CO Attainment + 0.1 x Indirect CO Attainment.

| CO | Direct CO Attainment% | Indirect CO Attainment (Obtained from | Total CO attainment |
|---|---|---|---|
| **CO1** | 66.35 | 90.00 | 78.17 |
| **CO2** | 63.61 | 85.00 | 74.31 |
| **CO3** | 65.66 | 87.00 | 76.33 |
| **CO4** | 67.72 | 90.00 | 78.86 |
| **CO5** | 61.56 | 85.00 | 73.28 |
| **CO6** | 64.29 | 89.00 | 76.65 |

If set target is not attained, then improvements must be planned to bridge the gap next time. Incase target attained or exceeded, attainment target may be enhanced next time.

## 7.4 Action Plans for Improving the CO Attainments

- Action plans need to be as specific as possible.
- Indicate if any additional resources (Physical resources, Learning resources) are required to implement the improvement plans.
- Indicate if any changes in the Lesson Plan are required.
- Avoid vague statements like “Motivate the students”, “Work harder”.
- If possible, have the action plans reviewed by peers.

# 8. PO and PSO attainment

## POs and PSOs:

A. **POs and PSOs are/can be addressed through**:

- Core courses
- Projects (Major and Mini)
- Seminars/Presentations
- Internships
- Co-curricular and Extra-Curricular Activities
  - For any activity to be considered for computing the attainment of POs/PSOs, all students of a program are required to participate in that activity.
  - For activities to be included for computing attainment, the related student performances should be measurable.

B. **Strength of CO-PO/PSO Mapping**

Attainment of a PO/PSO depends both on the attainment levels of associated COs and the strengths to which it is mapped

## List of PO, PSO assessment tools and processes

Broadly the data collection to measure the attainment of POs and PSOs is done through direct and indirect methods. The list of assessment tools is as stated in table

**a. PO Assessment tools based on learning domain**

Table8.1POAssessmenttoolsbased on learning domain

| **Learning Domain** | **POs** | **Tool** | **Data Collection theme** |
|---|---|---|---|
| Knowledge | PO1 | i) Test/Assignment<br>ii) SPPU Exam | Each question is mapped with CO, PO, BL & analysis of matrix obtained against set target |
| Problem Solving Skill | PO2, 3, 4, 5 | i) Assignment<br>ii) Mini/Major Project Lab Assessment<br>iv) Co-Curricular activities | A rubric is designed with performance indicators & analysis of rubric score obtained against set target. |
| Supportive skill | PO9, 10, 11 | i) Lab Assessments<br>ii) Project<br>iii) Co-curricular activities | A rubric is designed with performance indicators & analysis of rubric score obtained against set target |
| Attitude | PO6, 7, 8, 12 | i) Lab Assessments<br>ii) Project<br>iii) Co-curricular activities | A rubric is designed with performance indicators & analysis of rubric score obtained against set target |

## Relevancy of Assessment tools detail:

Table8.2RelevancyofAssessmenttools

| Tool | Frequency | Type | PO/PSO | Data Collected |
|---|---|---|---|---|
| Test (Internal) | After Completion of each unit | Direct | PO1-3 PSO1-3 | Actual CO Attainment of each Course based on Percentage of Students scoring The set targets. |
| Assignment (Internal) | After Completion of Each unit | Direct | PO1-5 PSO1-3 | |
| Lab Assessment (Internal) | After Completion of each practical | Direct | PO4-10 PSO1-3 | |
| Project Assessment (Internal) | 4reviewsper semester | Direct | PO1-12 PSO1-3 | |
| Student Activity (Internal) | Once based on course requirement | Direct | PO1-12 PSO1-3 | |
| SPPU Exam (External) | At the end of Each semester | Direct | PO1-5,9,10 PSO1-3 | |
| Exit Survey | At the time of Graduation | Indirect | All PO/PSO | Indirect attainment level of each PO/PSO based on survey/feedback analysis. |
| Employer feedback | Once every year | Indirect | All PO/PSO | |

## 8.3 Process for Attainment of PO and PSO

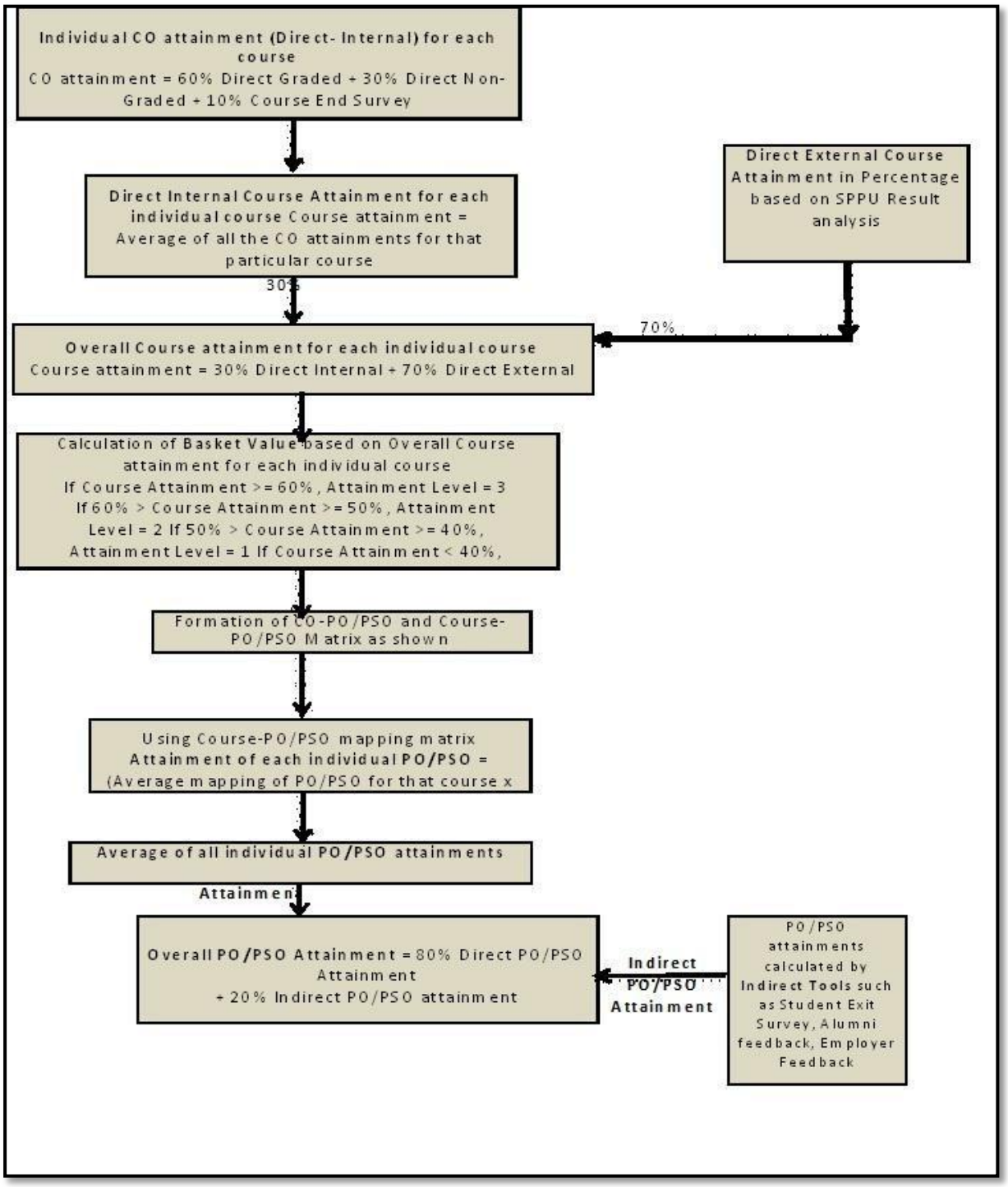



**Fig 8.1 Process For Attainment Of PO and PSO**

## 1. Mapping of CO with PO and PSO

| CLASS | COURSE/ SUBJECT | COURSE OUTCOMES | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| TE | XYZ | CO1 | 2 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 0 |
| | | CO2 | 3 | 2 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| | | CO3 | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 2 | 2 | 0 | 2 | 1 | 0 | 0 |
| | | CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 0 | 0 |
| | | CO5 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| | | CO6 | 2 | 2 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |

## 2. Average mapping calculation

| CLASS | COURSE/ SUBJECT | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| TE | | AVG | 2.33 | 1.67 | 1.67 | 1.00 | 1.00 | 1.33 | - | - | 1.20 | 1.40 | - | 1.50 | 1.00 | - | - |

## 3. Total CO Attainment

| CO | Total CO attainment |
|---|---|
| CO1 | 66.345 |
| CO2 | 63.61 |
| CO3 | 65.66 |
| CO4 | 67.715 |
| CO5 | 61.555 |
| CO6 | 64.29 |

## 4. PO/PSO Attainment

- Attainment of PO/PSO=(Average of attainments of relevant COs) x Scale Factor
- Scale Factor=(Actual Mapping Strength/Maximum Possible Mapping Strength) =Actual Mapping Strength/3

| PO | COs | Mapping Strength | PO/PSO Attainment |
|---|---|---|---|
| **PO1** | **CO1, CO2, CO3, CO4, CO5, CO6** | 2.33 | 50.37654 |
| **PO2** | **CO1, CO2, CO3, CO4, CO5, CO6** | 1.67 | 36.10679 |
| **PO3** | **CO1, CO2, CO3, CO4, CO5, CO6** | 1.67 | 36.10679 |
| **PO4** | **CO4** | 1.00 | 22.57167 |
| **PO5** | **CO4, CO6** | 1.00 | 22.00083 |
| **PO6** | **CO1, CO2, CO3, CO4, CO5, CO6** | 1.33 | 28.75571 |
| **PO9** | **CO1, CO2, CO3, CO4, CO5** | 1.20 | 25.9908 |
| **PO10** | **CO1, CO2, CO3, CO4, CO5** | 1.40 | 30.3226 |
| **PO12** | **CO1, CO2, CO3, CO4, CO5, CO6** | 1.50 | 32.43125 |
| **PSO1** | **CO1, CO2, CO3, CO4, CO5, CO6** | 1.00 | 21.62083 |

## Total Attainment of a PO/PSO

- Combine the Direct Attainment with the Indirect Attainment using suitable weights. Typical values are 0.8 and 0.2.
- Determine the Indirect Attainment based on all the relevant Surveys. (Graduate Exit Survey, Alumni Survey, Employer Survey)
- To calculate final PO and PSO attainment all courses attainment is recorded and average of each PO attainment is calculated.

**Total Attainment =** 0.8 x Direct Attainment + 0.2 x Indirect Attainment

| Sr. No. | Subject Code | Subject Name | PO1 | PO2 | PO3 | …. | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | C101 | EM-I | 1.00 | | | … | | | | | | | 1.00 | |
| 11 | C111 | FPL-I | 1.00 | 1.00 | | … | | | | | 1.00 | | | |
| 23 | C211 | AT | 2.00 | 2.00 | 2.00 | … | | 2.00 | 2.00 | | 1.00 | | | 1.00 |
| 27 | C302 | HT | 2.00 | 2.00 | 1.00 | … | 1.67 | 1.83 | 1.83 | 1.00 | 1.83 | | | 2.00 |
| 32 | C307 | NMO | 3.00 | 3.00 | 3.00 | … | | 1.40 | 2.00 | | 3.00 | 2.00 | | |
| 33 | C308 | DME-II | 2.00 | 1.83 | 1.50 | … | | 1.00 | 1.60 | | 1.00 | 1.00 | | |
| Average Direct Attainment | | | 1.66 | 1.62 | 1.57 | … | 1.19 | … | 1.62 | 1.06 | 1.40 | 1.51 | 1.59 | 1.64 |
| 80% of Average Direct Attainment | | | 1.33 | 1.29 | 1.25 | … | 0.95 | … | 1.30 | 0.85 | 1.12 | 1.21 | 1.27 | 1.31 |
| Indirect Attainment | | | 2.39 | 2.25 | 2.33 | … | 2.65 | … | 2.57 | 2.44 | 2.11 | 2.20 | 2.25 | 2.08 |
| 20% of Indirect Attainment | | | 0.48 | 0.45 | 0.47 | … | 0.53 | 0.55 | 0.51 | 0.49 | 0.42 | 0.44 | 0.45 | 0.42 |
| Overall attainment of PO/PSO | | | 1.81 | 1.75 | 1.72 | … | 1.48 | 1.81 | 1.81 | 1.34 | 1.54 | 1.65 | 1.72 | 1.73 |

## Closing the Quality Loop at the Program Level

For each PO and PSO:

- Attainment target is set by PAC, The attainment evaluation is performed by PAC
- Total attainment value for each PO and PSO is computed and checked it against target.
- The areas of weaknesses are identified in the program based on the analysis of evaluation of POs & PSOs attainment levels. Measures identified and implemented to improve POs & PSOs attainment levels for the next assessment years.

# Definitions

***Lectures:*** *The traditional class where the teacher speaks; students listen and take notes. These days lectures can be very interactive, allowing students to ask questions, providing time for students to discuss ideas with each other and so on. It is good practice to alternate delivery of content with more active student participation every 20 minutes or so.*

***Tutorials:*** *A smaller class (usually no more than 20 students) which provides an opportunity for discussion and feedback. The tutor will normally ask questions to check that students have understood the material and to encourage debate. Students may also be required to use this time to work in groups on set tasks and then feedback to the whole class.*

***Seminars:*** *Similar to a tutorial. A smaller class (usually no more than 20students) built around discussion and exploration of the module content. Sometimes students will be asked to prepare a short paper or presentation.*

***Laboratory Sessions:*** *in which students are guided to undertake practical experiments*

***Practicals /workshops:*** *These are sessions in which students practice their practical / skills*

***IT workshops:*** *These take place in a classroom with computers and are dedicated to teaching students how to use the software they need. They may also be used to engage students with electronic resources that help them learn more about their subject, such as through simulations, online quizzes and so on.*

***Directed reading:*** *This is where students are set tasks and asked to read material in between classes, in their own time.*

***Self-directed learning:*** *This refers to time that students study either by themselves, in pairs or in groups. They will usually be set a task, but they will need their own initiative to give shape to the task, for example by selecting and assessing journal articles, or by profiling contemporary or topical issues in their field.*

***Problem-based learning:*** *A method of teaching whereby students are set a problem and work in groups to research and solve it.*

# References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