Manakula Vinayagar Institute of Technology

NATIONAL BOARD OF ACCREDITATION

OBE MANUAL

2024-25

MANAKULA VINAYAGAR INSTITUTE OF TECHNOLOGY
PUDUCHERRY
EDUCATE EMPOWER EXCEL

Preface

Outcome Based Education (OBE) is an educational theory that can improve the quality of education delivered to young minds by means of setting a specified outcome. The outcome based education gives a very good flexibility to faculty and students in achieving their goals by adopting varied teaching and learning tools according to their capacity.

The main objective is ultimately to improve the quality of the graduates. The traditional methods of teaching is augmented by addition of measurable and realizable goals and are clearly evident by adopting outcome based education.

Benefits of OBE

The Students are more clear on the goals and are more relevant for current industrial demands at the end of graduation.

OBE provides an avenue for restructuring the curriculum and assessment procedures in education and involves higher order learning and mastery than conventional educational systems.

OBE promotes more student involvement in learning and also increases responsibility among students and provides a platform to demonstrate their abilities.

OBE provides better communication between teachers and students and improves students performance as they know what is expected and what is assessed.

OBE can provide a good strategy for continuous improvement.

India, OBE and Accreditation

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

Contents

Vision and Mission of the Institute

Vision

To be a globally reputed Technical Institution creating Competent leaders and Skillful innovators in Science, Technology and Management.

Mission

* Providing a dynamic and creative learning environment for its students to acquire exemplary technical, analytical, professional skills.
* Imbibing a spirit of innovation and research among its students and faculty for solving critical problems.
* Promoting Innovation, Employability and entrepreneurship skills through industry academia collaboration.
* Serving the society through technical intervention and creating socially responsible Professionals.

Core Values

Technology based Education
Industry interaction
Green campus
Community development
Global vision
Commitment to excellence
Social Responsibility

OBE Enactment

BEFORE SEMESTER BEGINS

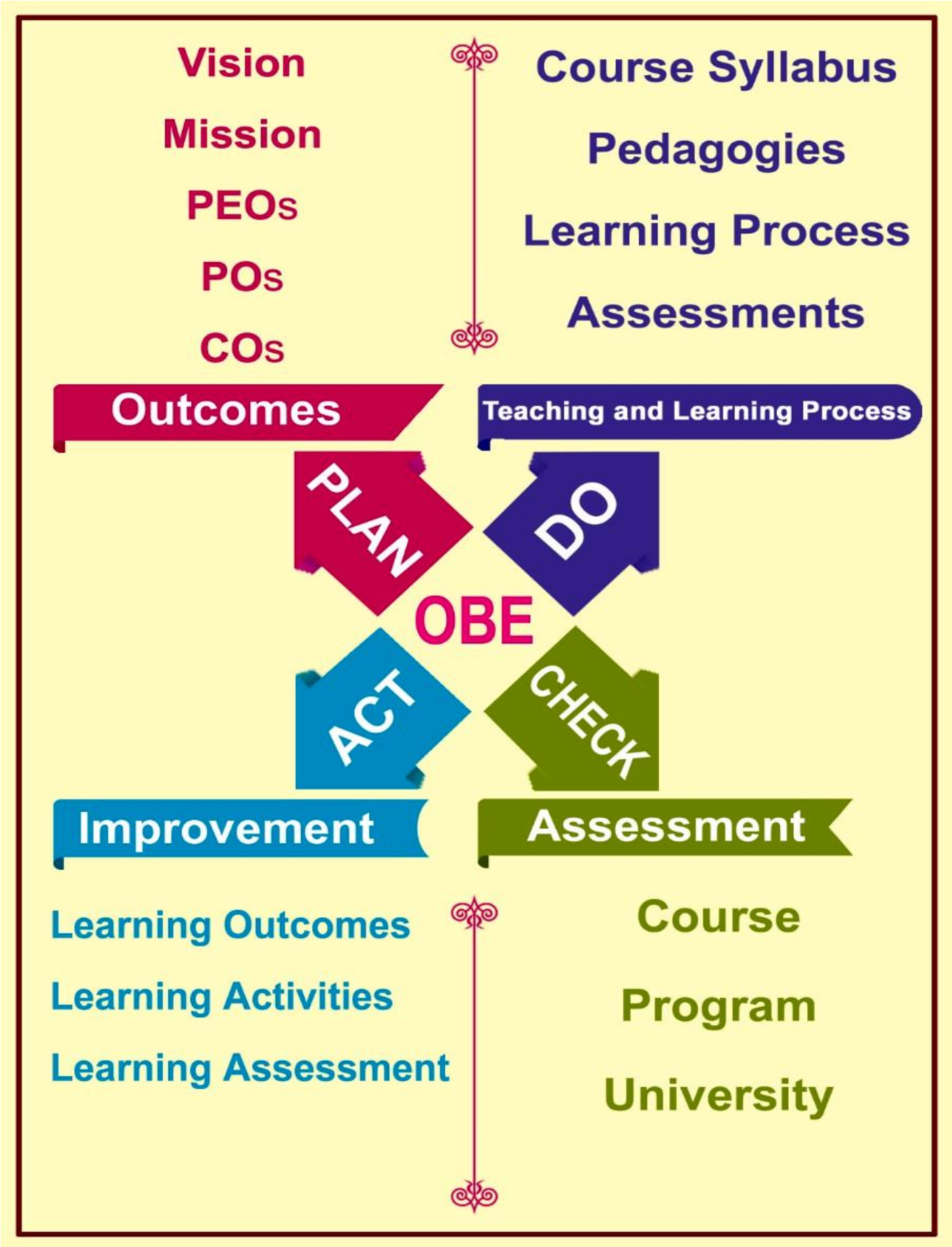
1. Subject Preference.
2. Subject allocation based on expertise.
3. Notes, Lesson plan, Course Information Sheet preparation.
4. Quality Assessment cell verification & approval of course contents.

DURING SEMESTER

1. Verification of Quality of Tests.
2. Feedback Analysis.
3. Quality circle meetings & Corrections.
4. Check on active teaching strategies by Heads.
5. Implementation of all activities.

END OF SEMESTER

1. Course exit survey.
2. Assessment & Evaluation of Co & PO attainments.
3. Academic audition quality of the contents delivered and suggestion for improvement.


Vision
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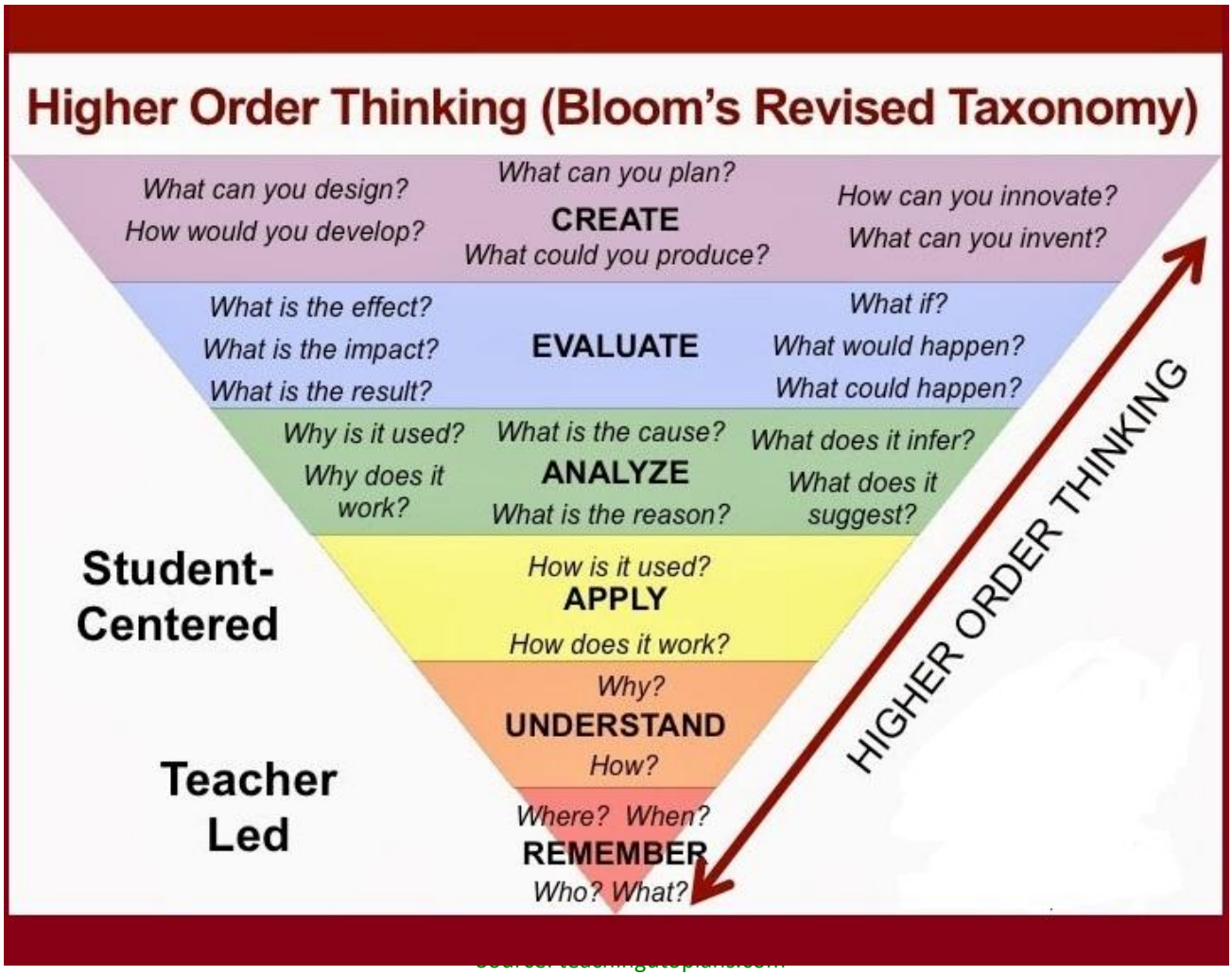
Procedure to be followed for Implementing OBE

- Every faculty member must write Course Outcomes (COs) for the subject allotted to them.
- The Course Outcomes are written with Bloom's Taxonomy action verbs indicating the cognitive level at which the faculty plans to teach based their expertise.
- CO – PO mapping has to be done using Blooms Taxonomy correlation level between written CO and POs.
- Activities and Assessment tools should be planned for each of the mapped values in CO-PO matrix.
- Faculty have to Prepare the Test items for the above CO-PO matrix based on Competency level and Performance Indicators.
- Faculty should plan and conduct activities like Quiz, Chart presentation, Assignment etc., for matrix values in the CO-PO map that is not covered by the Test Items.
- Faculty must take course Exit survey at the end of the semester for their subjects to get indirect attainment of COs.
- Faculty must calculate the CO attainments for each subject from the Internals exams results and university results. The PO attainments are calculated from CO-PO map values.
- Department will collect surveys for PO Indirect attainment and calculate the overall attainment.
- The Department Committee will verify the above process regularly.
- The scope for improvement and fixing targets for next academic years will be decided at the end of each academic year by Department Committee.

BLOOMS TAXONOMY

Understanding Various Levels of Bloom's Taxonomy



Note:

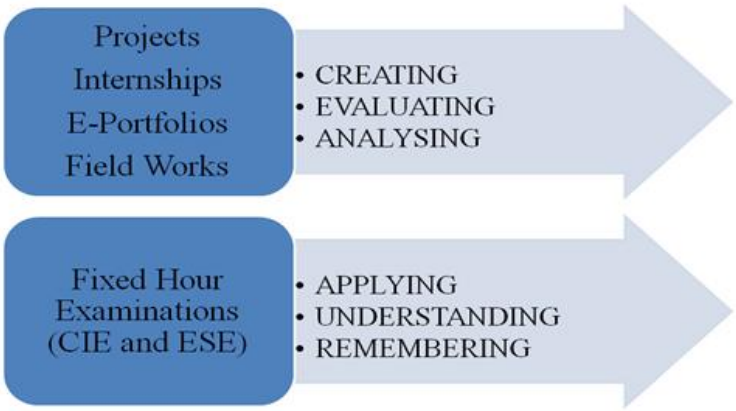
- The end semester written examinations can assess only very limited course outcomes and program outcomes.
- It means written examinations of time bound duration are not sufficient to make valid judgement about student learning.
- Therefore, some alternative assessment methods like problem solving assignments, projects portfolios etc. are required to assess the higher order skills at level 4, 5 and 6.

Top three levels i.e., Creating, Evaluating and up to some extent Analyzing are to be assessed by extended course works like projects, internship experiences and e-portfolios of students. Adoption of Bloom's Level framework should be implemented at university level for the sake of uniformity and to provide same playing field to all students regarding:

- Mapping of questions in the written examinations with Course Outcomes and then with Program Outcomes.
- Weightage of Bloom's Level attached to each question in the question paper.
- Criteria of assessment with mapping of questions in the viva-voce with Course Outcomes and then with Program Outcomes.
- Characteristics which are to be assessed.
- A rating scale which defines student's ability within each criterion.
- Mapping of scale with Course outcomes and hence Program outcomes.

Bloom's level	Description Attainment of Skill	Attainment of Skill
1	**Remembering**	Memorization of facts or knowledge attained in class or by reading the subject material.
2	**Understanding**	Explanation of previously learned material, ideas or concepts.
3	**Applying**	Use of knowledge attained for the application in another similar situation.
4	**Analyzing**	Split the information into parts and to find relationships between them and able to analyze.
5	**Evaluating**	Based on the work done and knowledge to justify the decision taken.
6	**Creating**	Develop and design a new concept or to generate a new idea while solving a problem.

Assessment Tools for Different Bloom's Levels



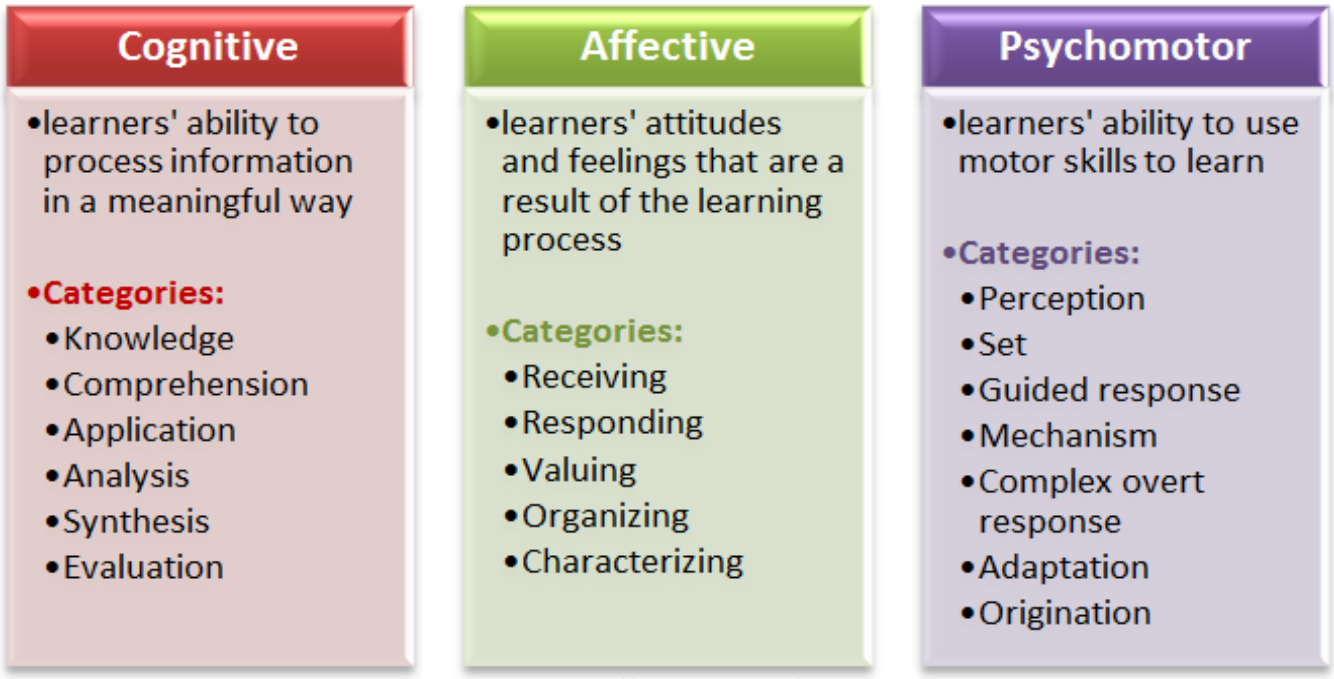
Learning Domains

"**Domains of learning**" refers to the three separate, yet interdependent components of learning outcomes achievable by human learners. These domains--cognitive, affective, and psychomotor represent various categories and levels of learning complexity and are commonly referred to as educational taxonomies.

The cognitive domain (*knowledge*) refers to knowledge attainment and mental/intellectual processes.

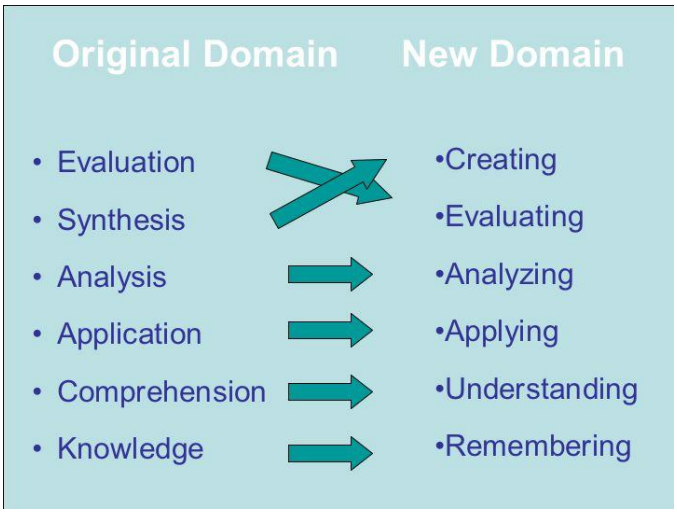
The affective domain (attitude or self) characterizes the emotional arena reflected by learners' beliefs, values and interests.

The psychomotor domain (manual or physical skills) reflects learning behavior achieved through neuromuscular motor activities.



Courtesy: https://tell.colvee.org/

The Revised Blooms Taxonomy in the cognitive Domain. This new taxonomy reflects a more active form of thinking and is perhaps more accurate.



Revised Bloom's Action Verbs for Course Outcomes

Remember	Understand	Apply	Analyze	Evaluate	Create
Arrange	Alter	Apply	Analyze	Appraise	Arrange
Cite	Classify	Change	Appraise	Argue	Assemble
Define	Convert	Choose	Ascertain	Assess	Collect
Identify	Defend	Compute	Associate	Attach	Combine
Label	Describe	Demonstrate	Breakdown	Choose	Comply
List	Discuss	Discover	Calculate	Compare	Compose
Memorize	Explain	Dramatize	Categorize	Conclude	Conceive
Match	Express	Draw	Compare	Critique	Construct
Name	Extend	Employ	Conclude	Deduce	Create
Order	Generalize	Illustrate	Contrast	Defend	Derive
Outline	Give examples	Interpret	Criticize	Estimate	Devise
Pronounce	Indicate	Manipulate	Designate	Evaluate	Expand
Quote	Locate	Modify	Determine	Judge	Extend
Recall	Paraphrase	Operate	Diagnose	Justify	Formulate
Recite	Recognize	Practice	Diagram	Predict	Generate
Recognize	Rephrase	Prepare	Differentiate	Prove	Integrate
Repeat	Restate	Produce	Discriminate	Rate	Invent
Reproduce	Reword	Schedule	Distinguish	Review	Modify
State	Rewrite	Show	Divide	Support	Originate
	Select	Sketch	Examine	Value	Plan
	Summarize	Solve	Experiment	Weigh	Prepare
	Translate	Use	Find		Project
			Infer		Rearrange
			Outline		Reconstruct
			Point out		Reorganize
			Separate		Set up
			Specify		Synthesize
			Subdivide		

Courtesy : IIT-KGP

Cognitive domain

The cognitive domain is focused on intellectual skills such as critical thinking, problem solving, and creating a knowledge base. It was the first domain created by the original group of Bloom's researchers. The cognitive hierarchy spans from simple memorization designed to build the knowledge of learners, to creating something new based on previously-learned information. In this domain, learners are expected to progress linearly through the hierarchy, beginning at "remember" and ending at "create."

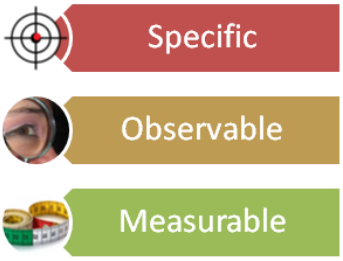
A search for "Bloom's Verbs" will provide lists of synonyms to use.

Course Outcome Formation

What should an CO contain?

Course Outcome (CO) describe what students are able to demonstrate in terms of knowledge, skills, and values upon completion of a course. Clear articulation of learning outcomes serves as the foundation to evaluate the effectiveness of the teaching and learning process.

Effective, learning objectives need to be **specific, observable** and **measurable** statements



The Components of a Measurable Course Outcome.

Three essential components of a measurable Course Outcome are:

- Student learning behaviors
- Appropriate assessment methods
- Specific student performance criteria / criteria for success When writing a measurable Course

Outcome, it is important to:

⇒ focus on student behavior

⇒ use simple, specific action verbs

⇒ select appropriate assessment methods

⇒ state desired performance criteria

Focus on Student Behavior.

Course Outcomes are about what students are able to demonstrate upon completion of a course. Course Outcomes are not about what the instructors can provide but what the students can demonstrate. The following are not Course Outcomes:

× Offer opportunities for students to master integrated use of information technology.

× The program will engage a significant number of students in a formalized language/cultural studies program.

× Students who participate in critical writing seminars will write two essays on critical thinking skills.

× Students will be exposed to exceptionality in learning disabilities including visual and perception disabilities.

Use Simple, Specific Action Verbs.

When writing Course Outcomes, focus on student behavior and use simple, specific action verbs to describe what students are expected to demonstrate.

The following are examples of Course Outcomes:

Students will be able to **collect** and **organize** appropriate clinical data (history, physical exam, laboratory assessments including technology advancements in diagnostic such as PCR).

Students will be able to **apply** principles of evidence-based medicine to determine clinical diagnoses, and formulate and implement acceptable treatment modalities.

Students will be able to articulate cultural and socioeconomic differences and the significance of these differences for instructional planning.

Students will be able to use technology effectively in the delivery of instruction, assessment, and professional development.

Students will be able to evaluate the need for assistance technology for their students.

Note: Bloom's Taxonomy can be a useful resource in developing Course Outcomes.

ACTION VERBS

Concrete verbs such as "define," "apply," or "analyze" are more helpful for assessment than verbs such as "be exposed to," "understand," "know," "be familiar with."

Cognitive Learning	Action Verbs:
Remember- to recall or remember facts without necessarily understanding them	arrange, define, duplicate, label list, memorize, name, order, recognize, relate, recall, reproduce, list, tell, describe, identify, show, label, collect, examine, tabulate, quote
Understand – to understand and interpret learned information	classify, describe, discuss, explain, express, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend, translate, review, restate, locate, recognize, report
Apply– to put ideas and concepts to work in solving problems	apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, calculate, complete, show, examine, modify, relate, change, experiment, discover
Analyze– to break information into its components to see interrelationships and ideas	analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test, separate, order, connect, classify, arrange, divide, infer
Evaluate– to judge the value of information based on established criteria	appraise, argue, assess, attach, defend, judge, predict, rate, support, evaluate, recommend, convince, judge, conclude, compare, summarize
Create – to use creativity to compose and design something original	arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, rewrite, integrate, create, design, generalize

Select Appropriate Assessment Methods.

Assessment methods are tools and techniques used to determine the extent to which the stated Course Outcomes are achieved. A variety of methods, qualitative and quantitative, direct and indirect, should be used. The following are examples of direct and indirect assessment methods:

Examples of Direct Assessment Methods:	**Examples of Indirect Assessment Methods:**
Internal assessment University Examinations Certification exams Assignments Mini-projects major project Internship evaluations Grading with scoring rubrics* Comprehensive exams	Course Exit Surveys after end of each course Employer surveys Program Exit Survey

State Desired Performance Criteria.

Performance criteria express in specific and measurable/observable terms that are acceptable to a specific course or program. Note that grades alone do not provide adequate feedback to students' performance because grades represent overall competency of students and do not identify strengths and weaknesses on specific Course Outcomes. However, if the grading system is tied to rubrics, it can be a useful tool to identify areas for improvement that should be addressed. The following is not an acceptable measurable Course Outcome:

> *Students will be able to communicate effectively, as demonstrated by obtaining at least a "C" grade in the course.*

With slight modification, the above Course Outcome can be stated in measurable terms.

✓ *Students will be able to communicate effectively, as exhibited by scoring at least 8 out of 10 for all the components within the grading criteria on the final writing assignment.*

Parts of a Course Outcome Statement

Performance: This component is a description of what learners will be able to do at the end of the learning experience. It is designated by an **action verb** so that it is ***observable***.

Conditions: The Component defines the conditions in which learners will perform the learning tasks. This is what makes your learning objective ***specific***.

Criteria: The component defines how learners will be assessed. This component of your learning objective is what makes it ***measurable***.

Example :

At the end of this lesson, you will be able to:

Bang the appropriate nail into a plank of press-board without splitting the wood.

Performance *Conditions* *Criteria*

Performance	Condition	Criteria
"What learners must be able to DO or PERFORM when they demonstrate mastery of an objective." You may answer Questions like *" What will the person be able to do after learning the topic?"* **Example** 1. *Be able to write a news article.* 2. *Construct a model car ..* 3. *Solve mathematically*	Describes the condition under which the learner performs an action. You may answer Questions like " What will you give the person to use?" "*what will be the environment?"* **Example** 1. *Using a Calculator* 2. *Using a transform in mathematics* 3. *Using a scale* 4. *In the daylight* 5. *Using a tool*	The criteria will tell the level of proficiency that is expected and it will tell how the learner will perform in terms of quantity, quality, and/or time measurements. You may answer questions like "*How many?" " How fast?" " How well?"* **Example** 1. *Within 10 minutes* 2. *80% or better* 3. *In compliance with the chart* 4. *Within acceptable industrial standards.*

Program Outcomes

PO1: Engineering knowledge: Apply knowledge of mathematics and science, with fundamentals of Engineering and Technology to be able to solve complex engineering problems related to Computer Science and Engineering.

PO2: Problem analysis: Identify, Formulate, review research literature and analyze complex engineering problems related to CSE and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

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

PO4: 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.

PO5: Modern tool usage: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to computer science related complex engineering activities with an understanding of the limitations.

PO6: 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.

PO7: Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply Ethical Principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary Settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as able to comprehend and with 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 management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: 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

CO-PO Course Articulation Matrix Mapping

Course Articulation Matrix shows the educational relationship (Level of Learning achieved) between Course Outcomes and Program Outcomes for a Course. This matrix strongly indicates whether the students are able to achieve the course learning objectives. The matrix can be used for any course and is a good way to evaluate a course syllabus. The Table gives information about the action verbs used in the POs and the nature of POs, stating whether the POs are technical or non-technical. We need to understand the intention of each POs and the Bloom's level to which each of these action verbs in the POs correlates to.

Type	**Program Outcomes**	Action Verb(s) in POs	Bloom's level(s) for POs
Technical	1	Apply	L3
	2	Identify Formulate Review	L2 L6 L2
	3	Design Develop	L6 L3
	4	Analyze Interpret Design	L4 L2 L6
	5	Create Select Apply	L6 L1,L2 L3
Non Technical	6	Rule of thumb	
	7		
	8		
	9		
	10		
	11		
	12		

Rule for CO-PO Mapping

- If the cognitive (Bloom's) level of the CO is same as that of the PO Level then the mapping is of high correlation i.e. Matrix value is 3.
- If the CO level is one less than the PO level than the correlation is Moderate and Matrix value is 2.
- If the CO level is less than the PO level by more that 2 or above than the correlation is weak and Matrix value is 1.

Note : Mapping values are to be entered only if the teacher is competent enough to ask a test item or any activity justifying the relation of a particular CO-PO. Otherwise the correlation is zero.

Thumb Rule for CO-PO Mapping

- If Bloom's L1 Action Verbs of a CO Correlates with any of PO6 to PO12 and assessment tool is planned by teacher then assign 1.
- If Bloom's L2 to L3 Action Verbs of a CO Correlates with any of PO6 to PO12 -and assessment tool is planned by teacher then assign 2.
- If Bloom's L4 to L6 Action Verbs of a CO Correlates with any of PO6 to PO12 and assessment tool is planned by teacher then assign 3

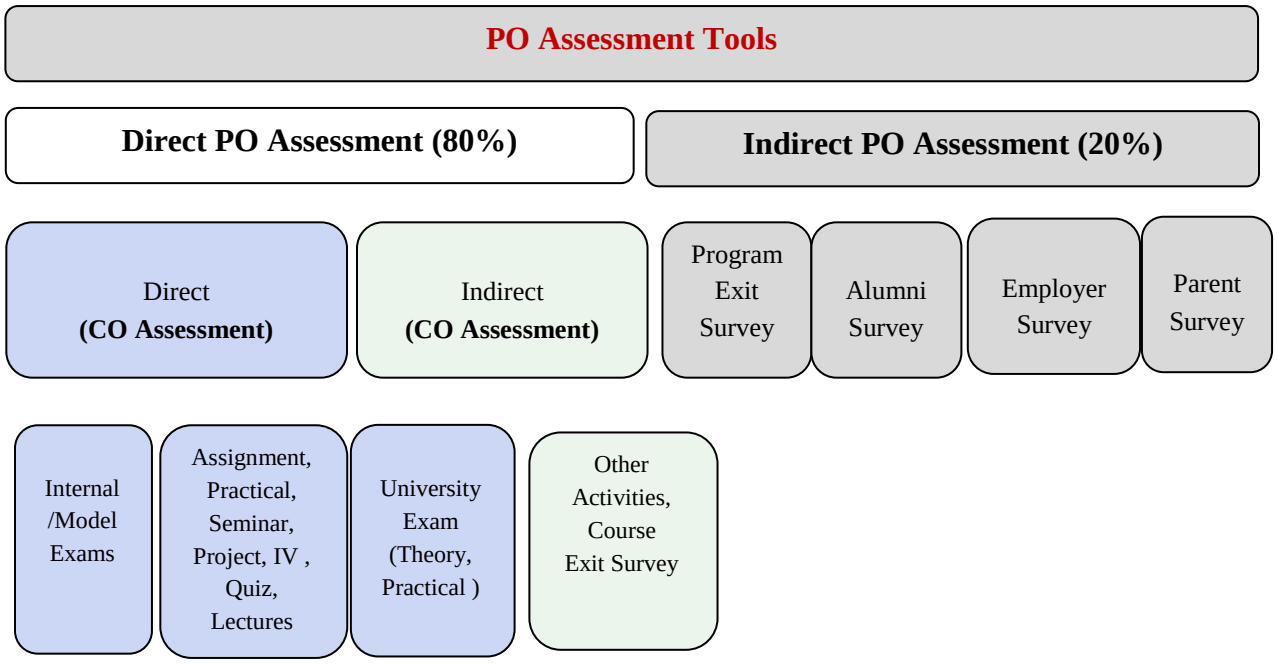
List of Assessment Tools

CO Assessment Tools

- ⇒ Internal Test
- ⇒ Model Test
- ⇒ University Exam
- ⇒ Practical/ Lab model exam
- ⇒ Industrial Visit
- ⇒ Workshops
- ⇒ Quiz
- ⇒ Assignment
- ⇒ Special /Invited Lectures
- ⇒ Projects
- ⇒ Seminar
- ⇒ Course Exit Survey
- ⇒ External Feedback

Direct Tools: (Measurable in terms of marks and w.r.t. CO)

Indirect Tools: (Non measurable in terms of marks and w.r.t. CO)



Test Item

The Test Item is to prepare the faculty for justifying the correlation of CO –PO matrix.

The Cognitive levels have identified five Dimensions (Clark, Chopeta, 2004; Clark, Mayer, 2007):

- **Facts** - Specific and unique data or instance.
- **Concepts** - A class of items, words, or ideas that are known by a common name, includes multiple specific examples, shares common features. There are two types of concepts: concrete and abstract.
- **Processes** - A flow of events or activities that describe how things work rather than how to do things. There are normally two types: business processes that describe work flows and technical processes that describe how things work in equipment or nature. They may be thought of as the big picture, of how something works.
- **Procedures** - A series of step-by-step actions and decisions that result in the achievement of a task. There are two types of actions: linear and branched.
- **Principles** - Guidelines, rules, and parameters that govern. It includes not only what should be done, but also what should not be done. Principles allow one to make predictions and draw implications. Given an effect, one can infer the cause of a phenomena. Principles are the basic building blocks of causal models or theoretical models (theories).

Formation of Questions for Examinations

- Questions are Framed with appropriate Blooms taxonomy action verbs
- Consider the cognitive dimension for setting test items .
- The Performance Indicator is given for each Program Outcomes correlating with the cognitive Dimension. (Ref Annexure)

Example

Q.No	Questions	Marks	CO	BL	PI
1	Derive Electric field Intensity at the given point due to line charge of infinite length.	11	CO1	K5	1.1.1
2	Solve for E at a point P(1,2,1) due to a point charge of 2nC at (1,1,1) and another charge 3mC at (1,0,1)	11	CO1	K3	3.1.6
3	State Gauss's law and give examples for any two applications	11	CO1	K2	1.3.1

Calculating CO-PO Attainment

- **Fixing the target for CO attainment**
  - Last 3 batch University exam results of a particular course and % of students obtained various grades are considered.
  - Particular grade and the last 3 years cumulative % of students who obtained this grade and higher, nearer to 50 or 60% is taken as the reference.
  - The target for the attainment for the next batch is fixed 5% above the reference

Sample calculation:

Department: Information Technology
Subject name: Computer Network **Subject Code: ITT61** **Semester: IV**

Batch	Grade							Total no of students
	S	A	B	C	D	E	F	
2018-22	1	17	15	19	3	0	0	55
2019-23	6	9	27	36	8	1	0	87
2020-24	0	16	38	27	5	3	0	89
Total	7	42	80	82	16	4	0	231
Percentage	3.03	18.18	34.63	35.5	6.93	1.73	0	
Cumulative%	3	21.21	**55.84**	91.34	98.27	100		

For 2021 - 25 Batch, attainment Target may be fixed as B Grade - 60%

- **Each Course outcome attainment based on Bloom's cognitive level**
  - Individual Student's attainment for each Course Outcome is calculated from the Internal Assessment marks, Course Exit Survey and University exam results.
  - The proficiency set for the course with various grades and expected proficiency attainment levels are set for each course outcomes (CO1, CO2…) based on the Bloom's cognitive level as given in Table 1 and this may be same for all the courses.

Blooms Level	Proficiency set for the course (%)					Expected Proficiency Attainment (EPA) set for the course (%)				
	Grade S	Grade A	Grade B	Grade C		EA ≥ 80	70≤EA<80	60≤EA<70	50≤EA<60	50>EA
Remember	100	90	80	70		90	80	75	65	55
Understand	100	90	80	70		90	80	75	65	55
Apply	90	80	70	60		80	70	65	60	50
Analyze	90	80	70	60		80	70	65	60	50
Evaluate	80	70	60	50		70	60	60	50	50
Create	80	70	60	50		70	60	60	50	50

- The Expected Proficiency Attainment (EPA) for all courses in a department gives the % of no of students to attain the targeted proficiency.
- The Expected Proficiency Attainment for all courses is set from the overall CO attainment target i.e, B Grade with 60%.
- If B Grade with 60% is taken as the target for Proficiency attainment % of attainment is minimum and hence we can take the next grade I.e., C Grade with 55%

Based on the above-given tables, the sample CO attainment (each CO) calculation for a theory course is given below.

Department: Information Technology
Subject name: Computer Network **Subject Code: ITT61** **Semester: IV**
Expected Proficiency for this course: C Grade
Expected Attainment (% of Students): 55%

CO No	Course Outcome	Blooms Level	Proficiency set for C Grade (%)	Expected Proficiency Attainment (% of Students) for 55%
1	Explain the principles of layered protocol architecture of network, service description	Understand	70	65
2	Explain conceptually, the working nature of the applications protocols such as HTTP, FTP, DNS, SMTP	Understand	70	65
3	Illustrate the working principles of reliable data transfer and explain the TCP & UDP protocols in transport layer	Apply	60	60
4	Describe the network layer design issues, IP addressing & inter and intra routing protocols	Apply	60	60
5	Demonstrate error correction and detection techniques in data link layer	Apply	60	60

Course Outcomes mapping with the students:

Normally course outcomes calculated from internal assessment marks, course exit survey and university result of a particular course. Sample course is taken to calculate the course outcomes and also given below.

Department: Information Technology

Subject name: Computer Network **Subject Code: ITT61** **Semester: IV**

S.No	Reg. No	Name	CO1	CO2	CO3	CO4	CO5
1	21TH0101	AARTHI.A	73	61	65	25	65
2	21TH0102	ABINAYA. C	60	63	40	65	60
3	21TH0106	AJAYRAJ.P	40	21	35	25	25
4	21TH0110	ANWAR BASHA. K	59	53	25	25	60
5	21TH0111	ASHOK KUMAR.M	52	66	70	25	65
6	21TH0114	BALAN. P	39	46	50	45	25
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •
57	21TH0217	YOGESHWARAN.G M	71	56	65	35	80
58	21TH0219	YUVARAJ.K	57	60	60	90	90
59	LE	SANTHAKUMAR.M	56	63	70	35	75
Average CO attainment through Internal Assessment (%)			**62.66**	**62.07**	**58.14**	**51.61**	**59.24**
Average CO attainment (60 %)			37.6	37.24	35	31	36
Course exit survey (10 %)			9.1	9	9.2	9	9.2
University Results (30 %)			29.5	29.5	29.5	29.5	29.5
Total			**76.2**	**75.74**	**73.7**	**69.5**	**74.7**

CO Attainment for The Above-Mentioned Course Through Internal Assessment Exams

CO No	Blooms Level	Proficiency set for C Grade (%)	Average CO attainment through Internal Assessment (%)	Expected Proficiency Attainment for 55 % (% of Students)	Actual Attainment as (%) of students
1	Understand	70	62.66	65	54.7
2	Understand	70	62.07	65	54.7
3	Apply	60	58.14	60	84.7
4	Apply	60	51.61	60	73.4
5	Apply	60	59.24	60	96.6

X = No of students got more than the proficiency set value for each Blooms level

Y = Actual EP Attained students strength for each CO = Class strength * EPA for each Blooms level

Actual Attainment as (%) of students for each CO = (X/Y)*100

Sample Calculations: For CO1, X = 23 students got more than the proficiency set

Y = 59 * 65/100 = 38.4

Actual Attainment as (%) of students for CO1 = (23/38.4) = 54.7 %

Course Exit Survey

Please rate each of the following skills, abilities or attributes in terms of their importance, and state how well, you're understanding about the course

Please rate each of the following skills, abilities or attributes in terms of their importance, and state how well, you're understanding about the course

Evaluation of CO

Scale 1 – Not Attained (Not satisfied) 2- Low attainment (Understood the CO, but skills need to be improved) 3 – Moderate (Satisfied in the attainment level of the CO) 4 – Above Moderate (Fair in the attainment level of the CO) 5 -High (Strong in the CO, acquired the skills in the specified cognitive level)

	1	2	3	4	5	Comments
1. Are you able to (CO1for the subject)						
2. Are you able to (CO2 for the subject)						
3. Are you able to (CO3 for the subject)						
4. Are you able to (CO4 for the subject)						
5. Are you able to (CO5 for the subject)						

PO Attainment through CO attainment

Illustration

Let us assume CO-PO mapping of a course, for example, **Computer Network is taken as a sample course from department of Information Technology** i.e.,

Department: Information Technology

Subject name: Computer Network **Subject Code: ITT61** **Semester: IV**

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1												
2	3	1												
3	3	2			2									2
4	3	2	1		2									2
5	3	1	1											
Average	**3**	**1.4**	**1**		**2**									**2**

Hence, final contribution of CO attainment in PO attainment can be done using the below formula,

CO Contribution = (Overall CO attainment/100) X (CO-PO Mapping weightage)

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1.64	0.55												
2	1.64	0.55												
3	2.54	1.69			1.69									1.69
4	2.2	1.47	0.73		1.47									1.47
5	2.9	0.97	0.97											
Average	**2.18**	**1.05**	**0.85**		**1.58**									**1.58**

Sample calculations:

CO1- PO1 mapping attainment 54.7 x 3/100 = 1.64 (up to 2 decimal places)

CO2- PO2 mapping attainment 54.7 x 1/100 = 0.55

CO3- PO5 mapping attainment 84.7 x 2/100 = 1.69

CO4- PSO2 mapping attainment 73.4 x 2/100 = 1.47

CO5- PO1 mapping attainment 96.6 x 3/100 = 2.9

Co-curricular Activity:

Analyze the data's and collect the no of students participated in Several CO-curricular activities.

Based on the expected number of students and the actual number of students who have participated in the attainment level calculation for each program outcomes.

Collection of data for various co-curricular activities

Co-Curricular Components	Expected Number of Students participated in this Activity (%)
NPTEL/Online Certification courses	90%
Project at Industries (Internship)/Higher learning Institutions	30%
Summer Training	90%
Participation in International/National Event	10%
Student Contest	80%
Publication along with the Faculty	80%
Placement	90%
Higher Studies	10%
Industrial Visit	90%
Professional Society Activities	95%
…….	……
…….	……

PO Articulation of Co-curricular Components:

Co-Curricular Components	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
NPTEL/Online Certification courses	3	3	2		2		2	2	2	1		2	2	1
Project at Industries (Internship)/Higher learning Institutions	3	3	2		2		1	1				2	1	1
Summer Training	3				1		1	1				1		
Participation in International/National Event	3	3	2		1		1	1		1		2	1	1
Student Contest	3	3	2		2			2	1			2	1	1
Publication along with the Faculty	3	3	2		2		1	1				2	1	1

Placement	3	3	2		2							2	2	2
Higher Studies	3	3	2		2						2	2	2	1
Industrial Visit	3	3	1				1	1				1	1	1
Professional Society Activities	3	3	2		1		1	1			2	2	1	2
Etc.,														

Data Collection for PO Calculation through various co-curricular-components

Co-Curricular Components	No of students participated/ Certified/ Placed
NPTEL/Online Certification courses	59
Summer Training	55
Participation in International/National Event	15
Student Contest	35
Publication along with the Faculty	59
Placement	47
Higher Studies	5
Industrial Visit	59
Professional Society Activities	59
Etc.,	

Actual PO attainment through Co-Curricular Components

Co-Curricular Components	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
NPTEL/Online Certification courses	3	3	2		2		2	2	2	1		2	2	1
Summer Training	3				1		1	1				1		
Participation in International/National Event	2.5	2.5	1.67		0.833		0.833	0.833		0.833		1.67	0.833	0.833
Student Contest	2.24	2.24	1.49		1.49			1.49	0.745			1.49	0.745	0.745
Publication along with the Faculty	3	3	2		2		1	1				2	1	1
Placement	2.66	2.66	1.77		1.77							1.77	1.77	1.77
Higher Studies	2.5	2.5	2		2						2	2	2	1
Industrial Visit	3	3	1				1	1				1	1	1
Professional Society Activities	3	3	1.67		0.833		0.833	0.833			1.67	1.67	0.833	1.67
Etc.,														
Sum	24.9	21.9	13.6	0	11.93	0	6.67	8.16	2.75	1.83	3.67	14.6	10.18	9.02
Maximum score	30	27	17	0	15	0	8	10	3	2	4	18	12	11
Percentage	**83**	**81.1**	**80**	**0**	**79.5**	**0**	**83.4**	**81.6**	**91.7**	**91.5**	**91.8**	**81.1**	**84.8**	**82**

X = No of students Done a particular co-curricular component

Y = Actual Attained students strength for each CO-curricular component = Class strength *Expected Number of Students participated in this Activity (%)

Actual Attainment of students for each PO = (X/Y)

Sample Calculations:

X = 59 students Done NPTEL/Online Certification courses

Y = 59*90/100= 53-Actual Attained students strength

Actual Attainment of students for PO1 = (X/Y) = 59/53=1.11

PO1 mapping attainment = 1.11*3 = 3.33 ≈ 3

Summary of Attainment of PO/PSO in %

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
83	72	79	67	65	66	73	66	78	85	65	74	78	85
71	77	66	77	66	66	67	73	77	75	80	77	66	80
77	76	74	80	71	77	80	69	74	82	68	66	72	66

Percentage Level for the attainment of POs

Component	Percentage
Curricular component	60%
Co-curricular Component	20%
Graduate Exit survey	20%

Program Outcomes	Curricular	Sub Total (60%)	Co-Curricular	Sub Total (20%)	Survey	Sub Total (20%)	Total
PO1	73	43.8	70	14	84	16.8	**74.6**
PO2	72	43.2	65	13	85	17	**73.2**
PO3	75	45	65	13	86	17.2	**75.2**
PO4	68	40.8	74	14.8	84	16.8	**72.4**
PO5	52	31.2	75	15	85	17	**63.2**
PO6	45	27	64	12.8	74	14.8	**54.6**
PO7	48	28.8	80	16	65	13	**57.8**

Improvements in Attainments of CO and PO

High Attainment of CO and PO — Increase Target value

Moderate Attainment of CO and PO — Target is not changed. Conduct more activities to attain the fixed Target

Low Attainment of CO and PO — Consider reducing the Target and analyze methodologies to attain the Targets.

No Attainment of CO and PO — Reduce Target and review the entire process of OBE to achieve the low level Attainments

Improvements for Non-Technical Program Outcomes

Improvements can be done by

- Personalized learning
- Blended Learning Activities
- Competitions
- Extension activities
- Industrial Interaction
- Project based Learning
- Innovative Assignments
- Teaching Life skills

ANNEXURE

Bloom's Taxonomy Usage

Remembering

Suppose a question of following kind is put before the students,

Who was the Author of book My Experiments with Truth?

(a) Jawaharlal Nehru

(b) Mahatma Gandhi

(c) Abraham Lincoln

(d) Nelson Mandela

The answer to above question is obviously (b). To answer above question, one need knowledge and he/she should be able to recall that from his/her memory. Therefore, above question is of Bloom's Level 1,i.e Remembering. Other questions of this level can be set using the action verbs who, tell, define, recall, identify, name, when, where, list etc. The first level therefore is to test the ability of student to recall the information/knowledge he/she has gained during the course of study.

Understanding

Let us examine the following question now,

Which of the following is true aboutCOVID-19 pandemic?

(a) It happened due to high level of pollution.

(b) It occurred in non-vegetarians only.

(c) It happened due to a virus from animal.

(d) It happened due to bacteria.

We know that the answer to above question is(c) but our purpose is to know how the candidate shall reach at the correct option. It is not a pure knowledge question because it requires the understanding of the concept as well. The candidate who has the understanding of viruses, bacteria etc., shall be able to answer above question, it means it tests the skill of understanding of the candidate. Therefore, it is a question of Bloom's Level 2. Another question of Level 2 can be like; "Explain the concept by which plants are able to generate oxygen during day time."Action verbs to set the questions of Level 2 can be describe, explain, summarise, interpret, discuss etc. which test the ability of student to translate knowledge to new context and understand the information.

Applying

Let us check the following question,

The Length of one side of a rectangular table is 3.0m and it's diagonal is 5.0m long.

Applying Pythagoras theorem to find the area of table?

(a) 15 meter square

(b) 25meter square

(c) 9 meter square

(d) 12meter square

The correct answer to above question is (d) and the student can reach at correct option if he/she has ability to apply the concept of Pythagoras theorem to his/her knowledge about rectangles. Questions starting with verbs like apply, illustrate, solve, use, demonstrate, determine, modify, calculate, model etc. can be set for Bloom's Level 3. To answer the question of Level 3, the candidate has to apply the knowledge and understanding of the concept hidden inside the statement of the question. One more example of this level may be: "Write the steps to prevent an epidemic to spread in your country keeping in view the guidelines issued by World Health Organization."

Analyzing

Fourth Bloom's Level is to test the ability of Analysis. It requires the skill to break down a problem into parts and then to find a relationship of the parts and the way the parts are organised.

Let us take the following question as an example of Level 4. The Table represents the relationship between annual income and number of children below 15years of age of select families of a locality.

Sl. No	Annual Income of family	No of Children with Age less than15 Years
1	Less than Rs 100,000	320
2	Rs 100,00 to Rs 500,000	200
3	Rs 500,000 to Rs 700,000	15
4	Rs 700,000 to Rs 1000,000	80
5	Above Rs 1000,000	20

From the Table, one can conclude that the families with lower income have more children. The examiner's question is which of the following assumptions would be correct to justify the conclusion?

(a) All families are able to send their children to expensive schools.

(b) The families with lower income group need fee concession for better education of their wards.

(c) The families with higher income are supporting the families in lower income group.

(d) Children belonging to the families of higher income are more intelligent than other families.

This question tests one's ability to have knowledge of value of currency, understanding of fee structure of schools and analysis of the data. Based on these abilities he/she shall tick option (b) as correct answer.

Evaluating

To achieve this level the candidate has to demonstrate the skill to compare between different ideas, make choices based on logical arguments and to make judgement by using some criteria. The action verbs for the problems to examine the student for this level may be measure, recommend, conclude, justify, assess, choose, compare, summarise, evaluate etc.

An example to clarify more is given below. A factory building work was going on smoothly with 100 workers which include 3 supervisors, one architect, 20 skilled labourers and other unskilled manpower, with this manpower the work was to finish in 45 days. The work stopped due to lockdown of the country and 70% of skilled and unskilled labourers left the job. Assess the delay in 01204356699

projects and recommend a comprehensive plan to finish the job in 90 days after opening of the lockdown with the manpower present on site. The roles of each worker are already defined..

Creating

This level is to examine the ability to create new idea using the existing concepts or to draw conclusions from a complex problem. The action verbs used to examine this skill are design, generate, develop, create, formulate, invent, compose, integrate etc. Following example is given in this reference:

In an online examination the web camera is used to monitor the candidates during examination but still some candidates cheat the examination. Develop a system using biometric credentials of candidates so that cheating can be curbed to minimum level including cheating in the form of impersonation.

Program Outcomes – Competencies - Performance Indicators.

PO1: Engineering Knowledge: apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.			
Competency		**Performance Indicators**	
1.1	Demonstrate competence in mathematical modeling	1.1.1	Apply mathematical techniques such as linear algebra, differential calculus, differential equations and integral calculus to solve problems
		1.1.2	Apply concepts of Complex Variable, probability, linear algebra, vector integration and transformation techniques to model and solve electronics engineering problems.
1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply engineering fundamentals
1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply electronics engineering concepts to solve engineering problems
PO2: Problem Analysis: identify, formulate, review research literature, and analyzecomplex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.			
Competency		**Performance Indicators**	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Articulate problem statements and identify objectives.
		2.1.2	Identify engineering systems, variables, and parameters to solve a problem
		2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe complex problems into interconnected sub-problems.
		2.2.2	Identify, assemble and evaluate information and resources
		2.2.3	Identify existing solution/methods for solving the problem, including forming justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution/methods to select the best methods.

2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy.
		2.3.2	Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Apply engineering mathematics to implement solution
		2.4.2	Analyze and interpret the results using contemporary tools.
		2.4.3	Identify the limitations of the solution and sources/causes of error.
		2.4.4	Arrive at conclusions with respect to the objectives.
PO3: Design & Development of Solutions: design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.			
Competency		**Performance Indicators**	
3.1	Demonstrate an ability to define a complex/open-ended problem in engineering terms	3.1.1	Recognize that need analysis is key to good problem definition
		3.1.2	Able to identify and document system requirements from stakeholders.
		3.1.3	Ability to review state of the art literature to synthesize requirements.
		3.1.4	Extract engineering requirements from relevant engineering codes and standards defined by ISO/IEC/IEEE.
		3.1.5	Explore and synthesize engineering requirements considering health, safety, risks, environment, cultural and societal issues
		3.1.6	Determine design, objectives, functional requirements and arrive at specifications
3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Ability to explore design alternatives.
		3.2.2	Build models/prototypes to develop diverse set of design solutions
		3.2.3	Identify suitable criteria for evaluation of alternate design solutions
3.3	Demonstrate an ability to select optimal design scheme for further development	3.3.1	Ability to perform systematic evaluation of the degree to which several design concepts meet the criteria.

		3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Refine a conceptual design into a detailed design within the existing constraints (of the resources)
		3.4.2	Generate information through appropriate tests to improve or revise design
PO4: Conduct Investigation of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.			
Competency		**Performance Indicators**	
4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purpose of investigation, its scope and importance
		4.1.2	Choose appropriate methods, algorithms, hardware/software tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation
		4.1.3	Apply appropriate hardware/software tools to conduct the experiment
		4.1.4	Establish a relationship between measured data and underlying physical principles
4.2	Demonstrate an ability to design experiments to solve open ended problems	4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures
		4.2.2	Understand the importance of statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3	Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to collect and analyze data
		4.3.2	Critically analyze data for trends and correlations, stating possible errors and limitations
		4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
		4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

PO5: Modern Tools 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.			
Competency		**Performance Indicators**	
5.1	Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools techniques and resources for engineering activities
		5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2	Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information (ii) modeling and simulating (iii) monitoring system performance, and (iv) creating engineering designs
		5.2.2	Demonstrate proficiency in using discipline specific tools
5.3	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1	Discuss limitations and validate tools, techniques and resources
		5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
PO6: 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.			
Competency		**Performance Indicators**	
6.1	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level.
6.2	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1	Interpret legislation, regulations, codes, and standards relevant to professional engineering practice and explain its contribution to the protection of the public.
PO7: Environment & Sustainability: understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.			
Competency		**Performance Indicators**	
7.1	Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity
		7.1.2	Understand the relationship between the technical, socioeconomic and environmental dimensions of sustainability

7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO8: Ethics: apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.			
Competency		**Performance Indicators**	
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2	Demonstrate an ability to apply the code of ethics	8.2.1	Identify tenets of code of ethics given by the professional bodies like IEEE.
		8.2.2	Examine and apply moral & ethical principles to known case studies
PO9: Individual & Team work: function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.			
Competency		**Performance Indicators**	
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas etc.) of effective team work, to accomplish a goal
9.2	Demonstrate effective individual and team operations---communication, problem solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
		9.2.2	Treat other team members respectfully
		9.2.3	Listen to other members
		9.2.4	Maintain composure in difficult situations
9.3	Demonstrate success in a team based project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts
PO10: Communication: communicate effectively on complex engineering activities with the engineering community and with 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.			
Competency		**Performance Indicators**	
10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed, and well-supported written engineering documents

		10.1.3	Create flow in a document or presentation- a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking and presentation	10.2.1	Listen to and comprehend information, instructions, and viewpoints of others
		10.2.2	Deliver effective oral presentations to technical and nontechnical audiences
10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

PO11: Project management & 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.

Competency		Performance Indicators	
11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity
		11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1	Analyze and select the most appropriate proposal based on economic and financial considerations
11.3	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity and the resources required to complete the tasks
		11.3.2	Use project management tools to schedule an engineering project so it is completed on time and on budget

PO12: 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.

Competency		Performance Indicators	
12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for requirement for continuing professional development
		12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

12.2	Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
		12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field.
12.3	Demonstrate an ability to identify and access sources for new information	12.3.1	Source and comprehend technical literature and other credible sources of information
		12.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability etc.

Program Specific Outcomes- Competencies-Performance Indicators.

PSO1: Products Development: Use modern tools to design subsystems for simple applications in Embedded Systems and VLSI.			
13.1	Ability to develop small prototypes of Embedded Systems	13.1.1	Select and use suitable Embedded systems and design prototypes
		13.1.2	Develop a product with innovation
13.2	Ability to simulate VLSI based systems	13.2.1	Simulate novel circuits using modern tools
		13.2.2	Analyze the developed VLSI based circuits for application in niche areas.
		13.2.3	Evaluate the simulation through FPGA Hardware and apply for real time systems
PSO1: Design Thinking: Apply engineering concepts to find solutions in the fields of Communications, Signal/Image Processing**.**			
14.1	Ability to design communication systems	14.1.1	Simulate simple communication systems for wired and wireless application
		14.1.2	Develop Protocols for networking and communication systems