Adi Shankara
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University
(Owned by Adi Sankara Trust)

OUTCOME BASED EDUCATION (OBE) MANUAL

ACADEMIC YEAR: 2024-2025

ADI SHANKARA

Adi Shankara was an Indian philosopher and theologian, born into a poor Brahmin family at Kalady in Kerala. He renounced the worldly pleasures at a very young age and chose 'sanyasa'. Throughout the course of his early life, Shankaracharya astounded many with his knowledge and intelligence. He started writing his own analysis of the Upanishads, Brahma Sutras and the Bhagavad Gita at a very young age. Shankaracharya amalgamated the ideologies of ancient 'Advaita Vedanta' and explained the basic ideas of Upanishads. He toured present-day India, Nepal, and Pakistan on foot, holding debates with other monks and philosophers.

Throughout the course of his journey, Shankaracharya discussed his ideas with various other philosophers and fine-tuned his own teachings from time to time. Shankaracharya found four monasteries (mutts) at the four cardinal points of India: The Jyotirmatha near Badrinath in the North; The Govardhanamatha at Puri (Jagannath) in the East; The Kalikamatha (Saradapitha) at Dwaraka in the West; and The Sringerimatha (again, Saradapitha) and they continue to spread his teachings. Adi Shankaracharya is renowned for his spectacular commentaries on ancient texts. His review of 'Brahma Sutra' is known as 'Brahmasutrabhasya', and it is the oldest surviving commentary on 'Brahma Sutra'. It is also considered as his best work. He also wrote commentaries on Bhagavad Gita, and the ten principal Upanishads. Adi Shankaracharya is also well known for his 'stotras' (poems). He composed many poems, praising gods and goddesses. He also composed the famous 'Upadesasahasri' which literally translates to 'a thousand teachings.' 'Upadesasahasri' is one of his most important philosophical works.

Having adorned the Sarvajna Peettam in Kashmir he completed his mission after which he walked up to Kailasa and merged in the supreme Sankara. In the form of his works he is still alive; people across the world are being benefited by Adi Shankara making him eternal.

ABOUT THE INSTITUTION

Ideally located in an idyllic ambience, the Institution kindles vibrant memories of the serene presence of Jagadguru Adi Shankara. Affiliated to APJ Abdul Kalam Technological University, Kerala and approved by AICTE, New Delhi. Established in 2001 and ably run by the Sringeri Mutt with the benign blessings of Sri Sri Bharathitheertha Mahaswamigal and Sri Sri Vidhushekhara Bharathi Mahasannidhanam, the ASIET boasts of state – of –the art infrastructure and an esteemed faculty of scholars trained at leading universities in India and abroad. It is affiliated to the A P J Abdul Kalam Technological University, approved by the AICTE and offers courses in UG, PG and PhD levels. Adi Shankara added yet another laurel as five of our UG programs are accredited by NBA (CE, CSE, ECE, EEE & ME), ensuring academic standards of global acceptance

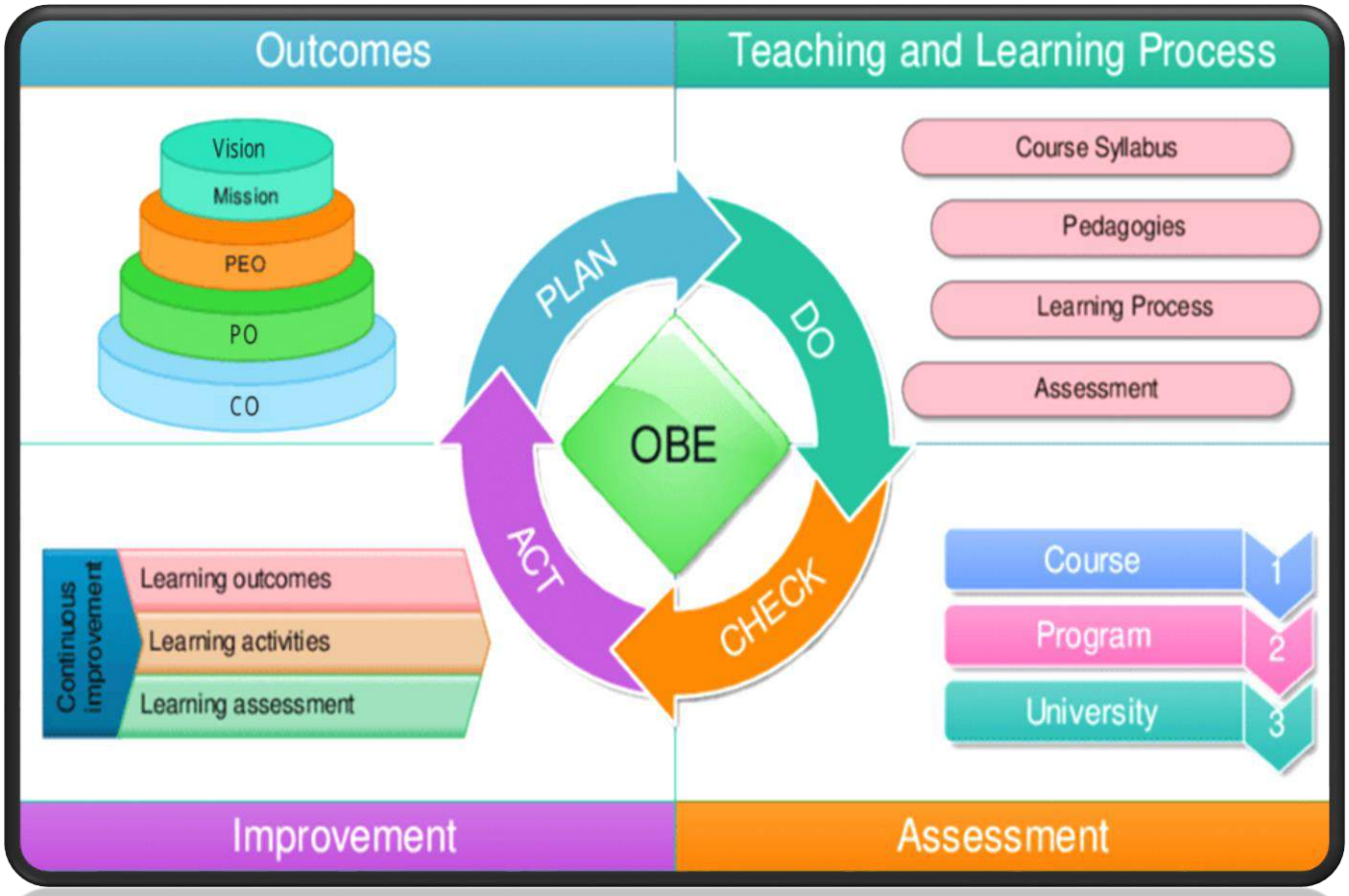
Adi Shankara Institute of Engineering & Technology was established at Kalady with the aim of providing value-added technical education with a flair of professional excellence and ethical values. The college is run by ADI SANKARA TRUST, a registered trust which has carved a niche in the educational sector. The trust has a legacy of running educational institutions for more than 50 years. The trust has the following educational institutions at Kalady

Sree Sankara College Sree Sarada School Adi Sankara Training College, DDU Kaushal Kendra Sree Sarada Special School

The reigns of the institution are with Guru Seva Nirata, Sri P. A. Murali, CEO & Administrator, Sringeri Mutt. Sri K. Anand is the Managing Trustee, who is fully committed to the overall development of the college. A team of highly qualified and dedicated faculty, under the direct supervision of the Principal, works untiringly for the betterment of students in all respects. With his wide experience in teaching and administration, he sets very high standards for the center.

ASIET believes in fostering all round development of the students. So we also place considerable emphasis on sports, co-curricular activities and in human values. Digital tools help in development of personality, as they make it possible for the students to interact with the teachers and others on a deeper level. The entire focus of education is on instilling qualities of self-reliance, courage, self-confidence and self-esteem in the students.

Foreword


Outcomes
Teaching and Learning Process
Vision
Mission
PEO
PO
CO
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DO
CHECK
ACT
OBE
Course Syllabus
Pedagogies
Learning Process
Assessment
Continuous improvement
Learning outcomes
Learning activities
Learning assessment
Course
Program
University
1
2
3
Improvement
Assessment

INDEX

Preface

Outcome Based Education (OBE) is an educational model that forms the base of a quality education system. There is no single specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set goals.

OBE enhances the traditional methods and focuses on what the Institute provides to students. It shows the success by making or demonstrating outcomes using statements "able to do" in favor of students. OBE provides clear standards for observable and measurable outcomes.

Benefits of OBE

- Clarity: The focus on outcome creates a clear expectation of what needs to be accomplished by the end of the course.
- Flexibility: With a clear sense of what needs to be accomplished, instructors will be able to structure their lessons around the students' needs.
- Comparison: OBE can be compared across the individual, class, batch, program and institute levels.
- Involvement: Students are expected to do their own learning. Increased student involvement allows them to feel responsible for their own learning, and they should learn more through this individual learning.

Outcome based education (OBE) is a student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills, attitude, and behavior. Its focus remains on evaluation of outcomes of the program by stating the knowledge, skills, attitude, and behavior a graduate is expected to attain upon completion of a program and even after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular engineering degree is predetermined and the students are evaluated for all the required parameters (outcomes) during the course of the program.

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes. The role of the faculty adapts into instructor, trainer, facilitator, and/or mentor based on the outcomes targeted. OBE reforms emphasize setting clear standards for observable, measurable outcomes. Nothing about OBE demands the adoption of any specific outcome. For example, many countries write their OBE standards so that they focus strictly on mathematics, language,science, and history, without ever referring to attitudes, social skills, or moral values. The keyfeature of an OBE system is a curriculum framework that clearly outlines specific, measurable outcomes.

The standards included in the frameworks are generally chosen through the normal development process of the discipline concerned. Assessment methods are chosen to determinewhether students have achieved the set standards. Assessments may take any form, so long asthey actually measure whether the students know the required information or can perform the required task.

Key Features of OBE

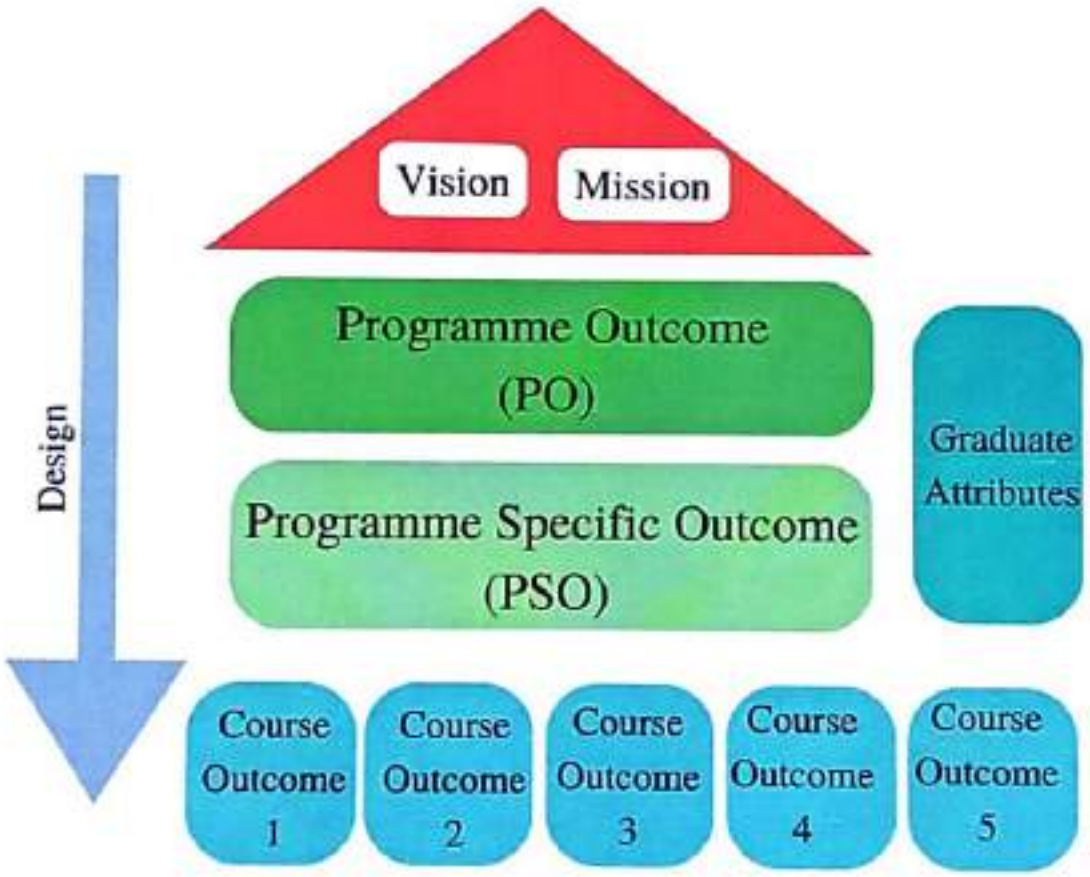
The OBE model measures the progress of a graduate in three sets of parameters, which are

- Course Outcomes (CO)
- Program Outcomes (PO)
- Program Specific Outcomes (PSO)

Course outcomes are the measurable parameters which evaluate each student's performance for each course that the student undertakes in every semester.

Program outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the 12 Graduate attributes as described by NBA for under graduate engineering programs.

NBA specifies to evaluate also a set of Program Specific Outcomes (PSOs) which are outcomes more specific to the subject of study of the graduate. It measures the subject/technical knowledge gained by a graduate.



Methods of Assessment

The method of assessment of candidates during the program is left for the institution to decide. The various assessment tools for measuring Course Outcomes include Mid - Semester and EndSemester Examinations, Tutorials, Assignments, Project work, Labs, Presentations, Employer/Alumni Feedback etc. These course outcomes are mapped to Graduate attributes or Program outcomes and Program Specific outcomes based on relevance. This evaluation patternhelps Institutions to measure the POs as well as PSOs. Program Educational Objectives are measured through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placementrecords and higher education records.

This Manual outlines the procedures followed at Adi Shankara Institute of Engineering and Technology (ASIET)for the implementation of OBE scheme in the College. It explains how PSOs, POs and COs are defined and evaluated. These outcomes defined by an institution should be in alignment with the Vision and Mission of the Institution.

Vision & Mission of the Institute

Vision of the Institution

To emerge as a Center of Excellence in Engineering, Technology and Management by imparting quality education, focusing on empowerment and innovation

Mission of the Institution

- Impart quality professional education for total upliftment of the society.
- Create congenial academic ambience that kindles innovative thinking and research.
- Mould competent professionals who are socially committed and responsible citizens.

Quality Policy

- We are committed to the total upliftment of the society by imparting quality professional education.
- We aim at modeling totally competent professionals with ingenuity, adaptability, social commitment and ethical and spiritual values by creating a congenial academic ambience that kindles innovative thinking.
- We continually upgrade the Quality Management System through empowerment and involvement.

The far sighted vision of the management has given a sense of direction to the development of the institute over the years. Starting with a simple beginning in 2001 with four B Tech programs and a student strength of just 180, the institute has grown to the present level, offering B. Tech in 10 streams, M. Tech in 3 streams, MBA, , MCA and Ph. D. programs, with a total student strength over 3500.

The Internal Quality Assurance Cell

AISET has constituted an Internal Quality Assurance Cell (IQAC) to oversee the activities and give directives in realizing the institute policy ensuring the required quality in higher education. The IQAC at ASIET functions with the following well-defined objectives.

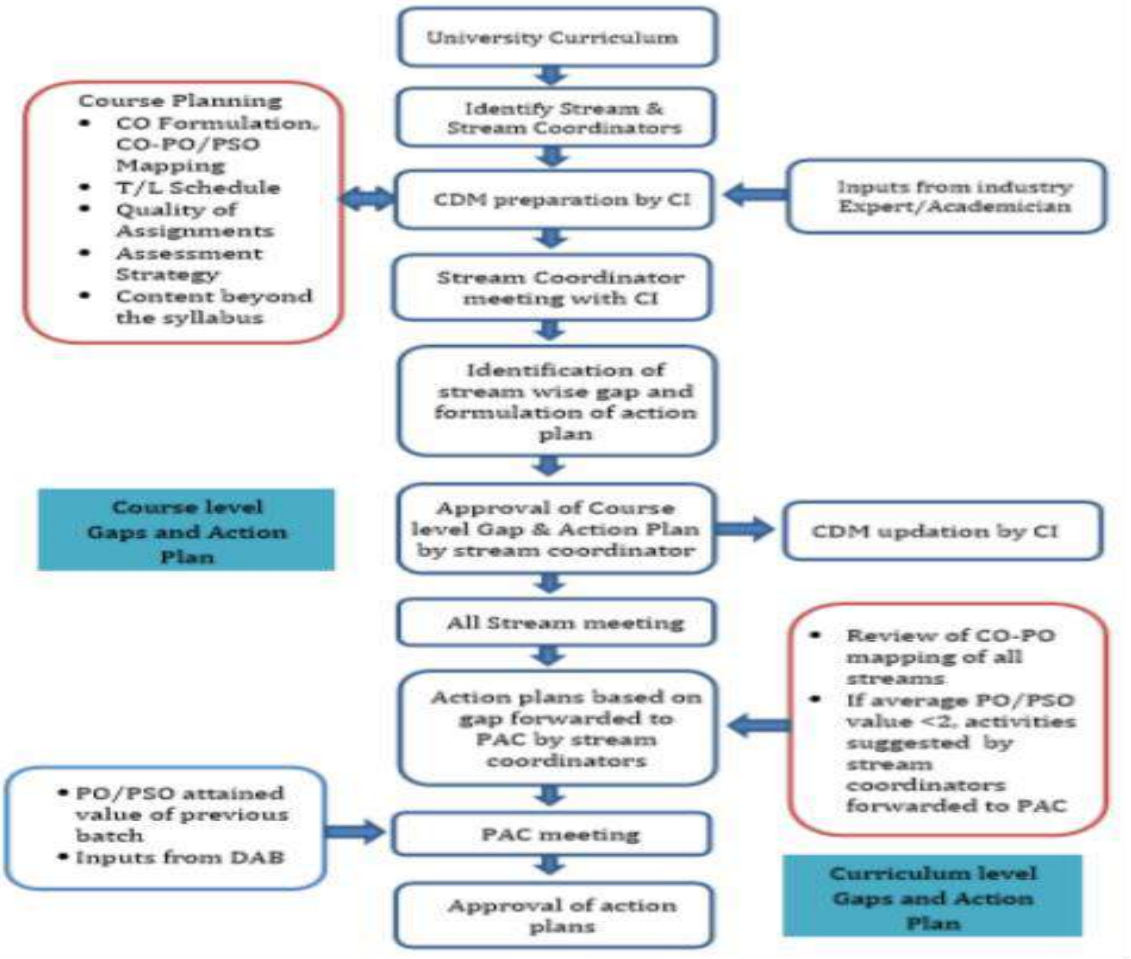
- Promoting pedagogical innovation and encouraging innovative teaching practices among the staff through staff development initiatives.
- Encouraging the use of e-resources and Learning Management Systems (LMS) for teaching and learning purposes.
- Conducting Academic and Administrative Audits (AAA) to ensure the effective functioning of the institution.
- Participating in surveys and assessments conducted by organizations like NIRF, NAAC, NBA for accreditation and rankings.
- Engaging in the international accreditation process to enhance global recognition and standards.

- Monitoring student progress and implementing a mentoring system for their academic and personal development.
- Organizing relevant seminars, workshops, industrial visits, and educational trips for students.
- Strengthening the Career Guidance and Placement Cell to enhance student's employability.
- Encouraging students to excel in various sports events and promoting a culture of physical fitness.
- Motivating faculty members to publish journals of international standards and adhere to UGC guidelines.
- Implementing feedback systems to gather input on faculty, curriculum, institutional performance, library facilities, and hostel facilities.
- Gathering feedback from parents, alumni, and employers to improve overall institutional functioning.
- Organizing annual Parents-Teachers Meetings to facilitate communication and collaboration.
- Engaging students in constructive and sensitive community services.
- Instilling a sense of social responsibility among students, teaching, and non-teaching members by extending help to marginalized communities through outreach activities.
- Sensitizing students towards national causes and nurturing their civic consciousness.
- Developing linkages and facilitating collaborations with national and global universities, institutions, industry and research organizations to promote research and academic collaborations.
- Organizing industry-academia meets to foster a holistic growth of academics through industry interactions.
- Facilitating the expansion of revenue sources through consultancy services.
- Assisting faculty members in applying to different state and central funding agencies for research projects.

OBE Framework

The OBE framework of higher education institutes are expected to bring changes to the curriculum by dynamically adapting to the requirements of the different stakeholders like Students, Parents, Employers and the Society at large. ASIET is affiliated to Kerala technological University KTU and hence the curriculum offered by KTU is delivered along with add on courses to meet the requirements of industry. The planning, delivery, and evaluation strategies of the curriculum are determined in academic council meeting and overseen by the Internal Quality Assurance Cell (IQAC) of the institution.

The Department Advisory Board (DAB) is constituted with HOD, academicians, stakeholders from industries and alumni to address the curriculum gaps, and proposes action plans. The Program Assessment Committee (PAC) is constituted with HOD, subject experts and stream coordinators.



OBE implementation in a technical institution requires theevaluation of the following four levels of educational outcomes

1. Program Outcomes (POs)
2. Program Specific Outcomes (PSOs)
3. Course Outcomes (Cos

Descriptions of these outcomes, their development and evaluation are outlined below.

Program Outcomes (POs)

Program Outcomes are broad in scope and achievable at the end of the program. POs are to be in line with the graduate attributes as specified in the Washington Accord. POs are to be specific, measurable and achievable. NBA has defined 12 POs or Graduate attributes, and a program need not re-define these POs by itself. These POs are common for all undergraduate engineering programs in India. There should be clear mention of the POs in the curriculum and the students should be aware of the spirit and implications of these POs. The 12 POs or Graduate attributes for a UG program in Engineering are listed below.

B. Tech - PROGRAM OUTCOMES (PO's)	
A graduate of a UG program in Engineering shall be able to demonstrate:	
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization tothe solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
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.

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 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 the 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, 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 theseto one's own work, as a member and leader in a team, to manage projects and in multidisciplinary 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.

M. Tech - PROGRAM OUTCOMES (PO's)	
PO1	An ability to independently carry out research/investigation and development work in engineering and allied streams
PO2	An ability to communicate effectively, write and present technical reports on complex engineering activities by interacting with the engineering fraternity and with society at large.
PO3	An ability to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
PO4	An ability to apply stream knowledge to design or develop solutions for real world problems by following the standards
PO5	An ability to identify, select and apply appropriate techniques, resources and state-of-the-art tool to model, analyse and solve practical engineering problems.
PO6	An ability to engage in life-long learning for the design and development related to the stream related problems taking into consideration sustainability, societal, ethical and environmental aspects
PO7	An ability to develop cognitive load management skills related to project management and finance which focus on Entrepreneurship and Industry relevance.
MBA - PROGRAM OUTCOMES (PO's)	
PO1	Apply Knowledge of management theories and practices to solve business problems
PO2	Foster Analytical and Critical thinking abilities for data-based decision making
PO3	Ability to develop value based Leadership Ability
PO4	Ability to understand, analyze and communicate global, economic, legal and ethical aspects of Business
PO5	Ability to lead themselves and others in the achievement of organisational goals contributing effectively to a team environment.

MCA - PROGRAM OUTCOMES (PO's)	
PO1	**Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
PO2	**Problem Analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
PO3	**Design /Development of Solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Computing 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, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
PO6	**Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
PO7	**Life-long Learning**: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
PO8	**Project Management and Finance:** Demonstrate knowledge and understanding of the computing 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.
PO9	**Communication Efficacy:** Communicate effectively with the computing

	community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
PO10	**Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.
PO11	**Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
PO12	**Innovation and Entrepreneurship:** Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are statements that describe what the graduates of a specific program in engineering shall be able to do at the end of graduation. PSOs are program specific, and is a measure of the competence of a graduate in the field of his/her study. A list of PSOs written for an UG program in Electronics & Communication Engineering are listed below. Similarly, each branch of Engineering will have different set of PSOs

B. Tech (Sample-EC) - PROGRAM SPECIFIC OUTCOMES (PSO's)	
A graduate of UG Engineering Program in Electronics and Communication shall demonstrate:	
PSO1	Identify and solve engineering problems related to analog and digital electronic systems and to design and implement them.
PSO2	Model a real world communication problem and to design and implement a suitable solution / system for the same.
PSO3	Solve complex engineering problems on signal processing and to design and simulate a suitable system using advanced tools.

Bloom's Taxonomy

Bloom's taxonomy is considered as the global language for education.

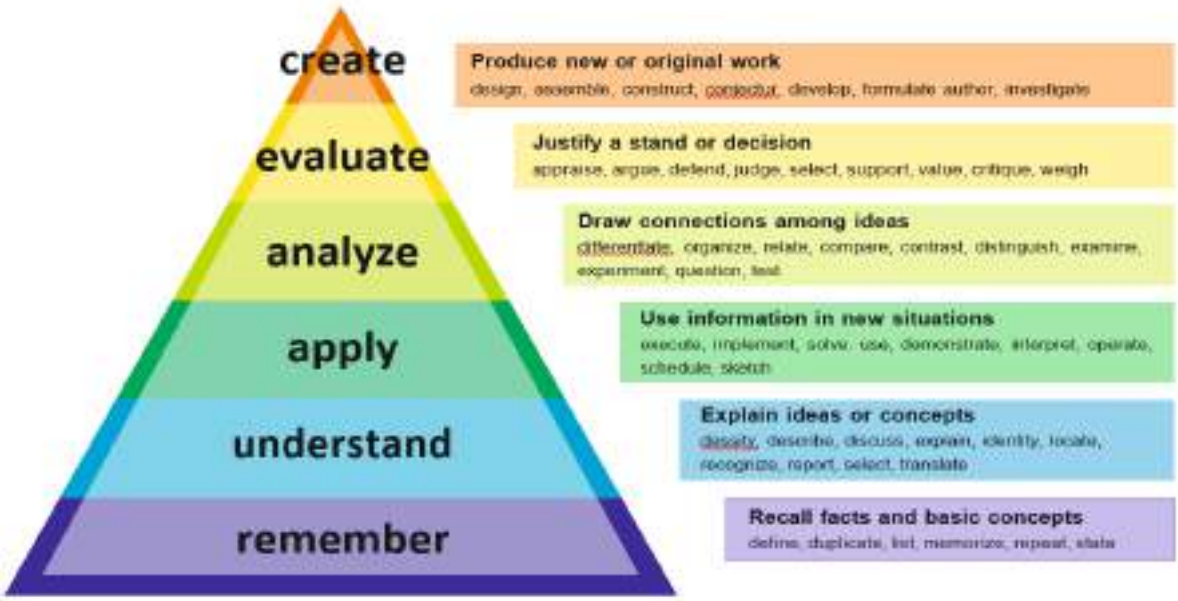


Fig: Revised Blooms Taxonomy

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

1. **Remember** –recalling relevant terminology, specific facts, or different procedures related to in- formation and/or course topics. At this level, a student can remember something, but may not really understand it.
2. **Understand** –the ability to grasp the meaning of information (facts, definitions, concepts, etc.)that has been presented.
3. **Apply** –being able to use previously learned information in different situations or in problem solving.
4. **Analyze** –the ability to break information down into its component parts. Analysis also refers to the process of examining information in order to make conclusions regarding cause and effect, interpreting motives, making inferences, or finding evidence to support statements/arguments.
5. **Evaluate** –being able to judge the value of information and/or sources of information based onpersonal 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 creatingtheir own thoughts and ideas

List of Action Words Related to Critical Thinking Skills

Here is a list of action words that can be used when creating the expected student learning out- comes related to critical thinking skills in a course. These terms are organized according to the different levels of higher-order thinking skills contained in Anderson and Krathwohl's (2001) re vised version of Bloom's taxonomy. Here is the revised Bloom's document with action verbs, which we frequently refer to while writing COs for our courses.

The cognitive process dimensions- categories:

Lower Order of Thinking (LOT)			**Higher Order of Thinking (HOT)**		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Interpreting Illustrating Classifying Summarizing Inferring (concluding) Comparing Explaining	Recognizing (Identifying) Recalling (Retrieving)	Executing Implementing	Differentiating Organizing Attributing	Checking (Coordinating, Detecting, Testing, Monitoring) Critiquing (Judging)	Planning Generating Producing (Constructing)

Action Verbs for Course Outcomes - Definitions

Lower order of thinking(LOT)			***Higher Order of Thinking (HOT)***		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Exhibit memory of previously learned material by recalling facts,terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas byorganizing, comparing, translating, interpreting, giving descriptions,and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalization	Present and defend opinions by making judgments about information, validity of ideas, or quality of work basedon a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solution.

Action Verbs for Course Outcomes (Continued)

Lower Order of Thinking(LOT)			*Higher Order of Thinking (HOT)*		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
• Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Outline • Relate • Rephrase • Show • Summarize • Translate • Experiment with • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate • Experiment with	• Organize • Plan • Select • Solve • Utilize • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize • Identify	• Divide • Examine • Function • Inference • Inspect • List Motive • Simplify • Survey • Take part in • Test for • Theme • Conclusion • Contrast	• Defend • Disprove • Estimate • Evaluate • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Criteria • Criticize • Compare • Conclude	• Create • Design • Develop • Estimate • Formulate • Happen • Imagine • Improve • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution

Guidelines for writing Course Outcome Statements

Course Outcomes (COs)

A Course Outcome is a formal statement of what students are expected to learn in a course. When creating Course Outcomes remember that the outcomes should clearly state what students will do or produce to determine and/or demonstrate their learning. Course learning outcome statements refer to specific knowledge, practical skills, areas of professional development, attitudes, higher- order thinking skills, etc. that faculty members expect students to develop, learn, or master during a course.

A well-formulated set of Course Outcome will describe what a faculty member hopes to successfully accomplish in offering their particular course(s) to prospective students, or what specific skills, competencies, and knowledge the faculty member believes that students will have attained oncethe course is completed. The learning outcomes need to be concise descriptions of what learning is expected to take place by course completion.

Developing Course Outcomes

Well-written course outcomes involve the following parts:

- Action verb
- Subject content
- Level of achievement as per BTL (Bloom's Taxonomy Level)
- Modes of performing task (if applicable)

When creating course outcomes consider the following guidelines as you develop them either individually or as part of a multi-section group

- Limit the course outcomes to 4 to 5 statements for the entire course [more detailed outcomes can be developed for individual units, assignments, chapters, etc. if the instructor(s) wish (es)].
- Focus on overarching knowledge and/or skills rather than small or trivial details
- Focus on knowledge and skills that are central to the course topic and/or discipline.
- Create statements that have a student focus rather than an instructor centric approach (basic e.g., "upon completion of this course students will be able to list the names of the 28 states and 8 union territories" versus "one objective of this course is to teach the names of the 28 states and 8 union territories").
- Focus on the learning that results from the course rather than describing activities or lessons that are in the course.
- Incorporate and/or reflect the institutional and departmental missions.
- Include various ways for students to show success (outlining, describing, modelling, depicting, etc.) rather than using a single statement such as "at the end of the course, students will know" as the stem for each expected outcome statement.

When developing learning outcomes, here are the core questions to ask oneself:

- What do we want students in the course to learn?
- What do we want the students to be able to do?
- Are the outcomes observable, measurable and are they able to be performed by the students?

Course outcome statements on the course level describe

- What faculty members want students to know at the end of the course AND
- What faculty members want students to be able to do at the end of the course

Course outcomes have three major characteristics

- They specify an action by the students/learners that is observable
- They specify an action by the students/learners that is measurable
- They specify an action that is done by the students/learners rather than the faculty members

Effectively developed expected learning outcome statements should possess all three of these characteristics. When this is done, the expected learning outcomes for a course are designed so that they can be assessed.

Tips for Assigning the values while mapping COs to POs.

1. Select action verbs for a CO from different Bloom's levels based on the importance ofthe particular CO for the given course.
2. Stick on to single action verbs while composing COs but you may go for multiple action verbs if the need arises.
3. You need to justify for marking of the values in CO-PO matrix. Use a combination of words found in the COs, POs and your course syllabus for writing the justification. Restrict yourself to one or two lines.
4. Values to CO-PO (technical POs in particular) matrix can be assigned by
   (a) Judging the importance of the particular CO in relation to the PO s. If the CO matches strongly with a particular PO criterion then assign 3, if it matches moderately then assign 2 or if the match is low then assign 1 else mark with "- " symbol.
   (b) If an action verb used in a CO is repeated at multiple Bloom's levels, then you need to judge which Bloom's level is the best fit for that action verb

CO – PO/PSO Mapping

The mapping of all courses of a program, in terms of COs, with POs and PSOs need to be done. The example quoted here is for a B Tech program in Electronics and Communication Engineering. Similar documents are prepared for all Courses and Programs offered in the Institution.

ECT 463- Machine Learning [Sample]

Course Outcomes

CO1. Explain the basics of machine learning and different types.

CO2. Illustrate regression and classification algorithms in supervised learning.

CO3. Apply linear algebra and statistical methods in discriminant-based algorithms.

CO4. Describe the basics of unsupervised learning and non-metric methods.

CO5. Understand ensemble, dimensionality reduction, and evaluation and model selection methods.

CO-PO and CO-PSO mapping

CO\PO &PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3													1	2
2	3	3	3	3	3				3	2		3		1	2
3	3	3	3	3	3					2		3		1	2
4	3											3		1	2
5	3	2			3					2		3		1	2

1-Slightly, 2-Moderately, 3-Strongly

Methods for Measuring Course Outcomes and Value Addition

There are many different ways to assess student learning. In this section, we present the different types of assessment approaches available and the different frame works to interpretthe results.

i) Continuous Internal Assessment (CIA)
ii) Laboratory and project work
iii) Course exit survey
iv) Program exit survey
v) Alumni survey
vi) Employer survey
vii) Course expert committee
viii) Department Advisory Board (DAB)
ix) Faculty meetings
x) Professional societies

The above assessment indicators are detailed below.

Continuous Internal Assessment (CIA)

Two Continuous Internal Examinations (CIEs/IAs) are generally conducted for all courses by the Department. All students must participate in this evaluation process following University Regulations.

Assessment Activity	Duration	Modules Covered	Weightage in CIA (%)
Internal Assessment Tests (IA)			
Internal Assessment I (IA 1)	90 Minutes	1 & 2	25
Internal Assessment II (IA 2)	90 Minutes	3 & 4	25
Learning Assessments (LA)			
Module Test	60 Minutes	1/2/3/4/5	10
Other Learning Assessments (LA)			
LA (xx) *(Exclusively for Module 5)*		5	10
LA (xx)		1/2/3/4/5	10
Attendance			20
		Total	100

These evaluations are critically reviewed by HOD and Class teacher and the essence is communicated to the faculty concerned to analyze, improve and practice so as to improve the performance of the student.

Laboratory and Project Works.

The laboratory work is continuously monitored and assessed to suit the present demands of the industry.

Course Exit Surveys

Students are encouraged to fill-out a brief survey on the fulfillment of course objectives. The data is reviewed by the concerned course faculty and the results are kept open for the entire faculty. Based on this, alterations or changes to the course objectives are undertaken by thorough discussions in faculty and PAC meetings.

Program Exit Survey

The program exit questionnaire form is to be filled by all the students leaving the institution. The questionnaire is designed in such a way to gather information from the

students regarding the program educational objectives, solicit about program experiences, career choices, as well as any suggestions and comments for the improvement of the program. The opinions expressed in exit interview forms are reviewed by the PAC for implementation purposes.

Alumni Survey

The survey asks former students of the department about the status of their employment and further education, perceptions of institutional emphasis, estimated gains in knowledge and skills, involvement as an undergraduate student. This survey is administered every year. The data obtained shall be analyzed and used in continuous improvement.

Employer Survey

The main purpose of this employer questionnaire is to know the employer's views about the skills they require of employees compared to the skills actually possessed by them. The purpose is also to identify gaps in technical and vocational skills, need for required training practices to fill these gaps and criteria for hiring new employees. These employer surveys are reviewed by the IQAC and College Academic Council to affect the present curriculum delivery and add on courses to suit the requirement of the employer.

Department Advisory Board (DAB)

The Departmental Advisory Board plays an important role in the development of the department. Department level Advisory Board will be established for providing guidance and direction for qualitative growth of the department. The Board interacts and maintains liaison with key stakeholders. DAB will Monitor the progress of the program and develop or recommend the new or revised goals and objectives for the program. Also, the DAB will review and analyze the gaps between curriculum and Industry requirements and give necessary feedback or advice to be taken to improve the curriculum.

Faculty Meetings

The DAC normally meets bi-annually for every academic year to review the strategic planning and modification of PEOs. Faculty meetings are conducted at least once in fortnight forensuring the implementation of DAC’s suggestions and guidelines. All these proceedings are recorded and kept for the availability of all faculties.

Professional Societies

The importance of professional societies like IEEE, IETE, ISTE, IE(I) etc., are explained to the students and they are encouraged to become members of the above to carry out their continuous search for knowledge. Student and faculty chapters of the above societies are constituted for a better technical and entrepreneurial environment. These professional societies promote excellence in instruction, research, public service and practice.

CO - Assessment Processes and Tools

Course outcomes are evaluated based on two approaches namely direct and indirect assessment methods. The direct assessment methods are based on the Continuous InternalAssessment (CIA) and University Examination whereas the indirect assessment methods are based on the course exit survey The weightage in CO attainment of Direct andIndirect assessments are illustrated in the table below.

Assessment Method	Assessment Tool	Weightage in CO attainment
Direct Assessment	Continuous Internal Assessment	80%
	End Semester University Examination	
Indirect Assessment	Course Exit Survey	20%

Direct Assessment

Direct assessment methods are based on the student's knowledge and performance in the various assessments and examinations. These assessment methods provide evidence that a student has command over a specific course, content, or skill, or that the students work demonstrates a specific quality such as creativity, analysis, or synthesis.

The various direct assessment tools used to assess the impact of delivery of course content are listed below.

Tools		Process	Frequency
Continuous Internal Assessment (60 %)	Internal Assessments	• Taken for every course • Gives an overall view that helps to assess the extent of coverage/compliance of COs	Twice in a semester
	Learning Activities		Number of activities not restricted and spreads throughout the entire semester
End Semester Examination (40%)		• Scheduled and evaluated by the University	Once at the end of the semester

- Continuous internal examination, Learning activities (includes assignment, open book tests, quiz, seminars etc.) and University examinations are used for CO calculation.
- The attainment values are calculated for individual courses and are formulated and summed for assessing the POs.

Indirect Assessment

Course Exit Survey - In this survey, questionnaires are prepared based on the level of understanding of the course and the questions are mapped to Course Outcomes. The tools and processes used in indirect assessment are shown in Table.

Tools used in Indirect assessment

Tool	Process	Frequency
Course exit survey	• Taken for every course at the end of thesemester • Gives an overall view that helps to assess the extent of coverage/ complianceof Cos • Helps the faculty to improve upon the various teaching methodologies	Once in a semester

PO/PSO - Assessment Tools and Processes

The institute has the following methods for assessing attainment of POs/PSOs.

- Direct method
- Indirect method
-

The attainment levels of course outcomes help in computing the PO/PSO based upon the mappingdone.

	Assessment	Tools	Weight
POs/PSOs Attainment	Direct Assessment	CO attainment of courses	80%
	Indirect Assessment	Student exit survey	20%
		Alumni survey	
		Employer survey	

The CO values of both theory and laboratory courses with appropriate weightage as per CO-PO mapping, as per mapping Matrix are considered for calculation of direct attainment of PO/PSOs.