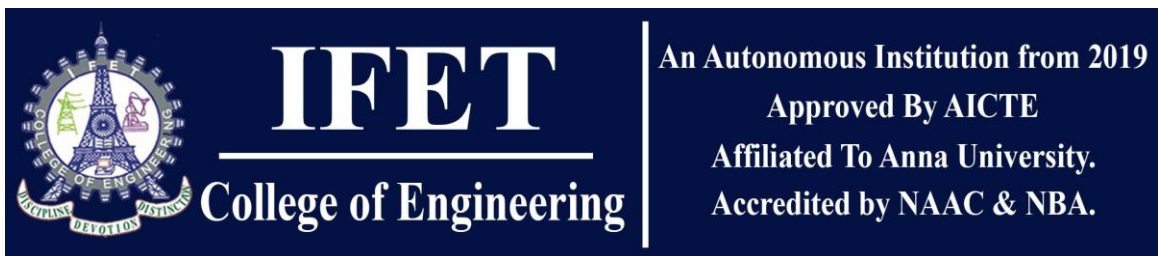


MANUAL  
FOR  
CO – PO / PSO ATTAINMENT AND  
ASSESSMENT PROCESS



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## **1. INSTITUTE VISION AND MISSION**

### **VISION**

To Deliver quality education of international standard and produce engineers competent at Regional, National and Global levels.

### **MISSION**

Striving to be the best in what we do, persistent and relentless in our pursuit of quality and never being satisfied with the status quo.

## **2. DEPARTMENT VISION AND MISSION**

### **VISION**

To produce demand driven, quality conscious and globally recognized computer professionals, by providing education of highest standard in diverse domains.

### **MISSION**

- To impart high quality professional training in postgraduate and undergraduate level.
- To bring out the inherent talents by promoting collaborative activities.
- To inculcate ethical values and the spirit of entrepreneurship.

### 3. PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

#### Program Educational Objectives (PEOs):

**PEO 1** The graduates will have an exposure on emerging cutting edge technologies, lifelong learning, adequate training and opportunities to work as teams on multi-disciplinary projects with effective communication skills, individual, supportive and leadership qualities.

**PEO 2** The graduates will be able to apply basic and contemporary science, engineering, experimentation skills to identify software/hardware problems in the industry and academia and be able to design, develop and provide practical solutions to them.

**PEO 3** The graduates will be able to establish an understanding of professionalism, ethics, public policy and aesthetics that allows them to become good professional Engineers.

**Program Outcomes (POs):**

**Program outcomes:** POs describe what students are expected to know or be able to do by the time they graduate from the program. At the time of their graduation, the B.E. Computer Science and Engineering students will have the following abilities.

<b>PO 1</b>	<b>Engineering knowledge</b>	Apply knowledge of mathematics, science, engineering fundamentals and computer science engineering specialization to the conceptualization of engineering models.
<b>PO 2</b>	<b>Problem analysis</b>	Identify, formulate, research literature and solve complex engineering problems reaching substantiated conclusions using first principles of mathematics and computer science engineering.
<b>PO 3</b>	<b>Design / development of solutions</b>	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
<b>PO 4</b>	<b>Conduct investigations of complex Problem</b>	Conduct investigations of complex problems including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
<b>PO 5</b>	<b>Modern tool usage</b>	Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
<b>PO 6</b>	<b>Individual and team work</b>	Function effectively as an individual, and as member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 7</b>	<b>Communication</b>	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

<b>PO 8</b>	<b>The engineer and society</b>	Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
<b>PO 9</b>	<b>Ethics</b>	Understand and commit to professional ethics and responsibilities and norms of engineering practice.
<b>PO 10</b>	<b>Environment and sustainability</b>	Understand the impact of engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.
<b>PO 11</b>	<b>Project management and finance</b>	Demonstrate a knowledge and understanding of management and business practices, such as risk and change management, and understand their limitations.
<b>PO 12</b>	<b>Life-long learning</b>	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologies.

**Program Specific Outcomes (PSOs):**

Program Specific Outcomes are statements that describe what the graduates of a specific engineering program should be able to do.

**PSO 1** Apply the fundamental knowledge of science & mathematics to design and develop software applications, analog & digital circuits, operating system, computer networks and implement software & hardware systems.

**PSO 2** Develop competence in analytical, logical & programming skill related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

**PSO 3** Ability to investigate dynamic technology scenario and use computer-aided software engineering tools for developing innovative projects in computing technologies to solve real world application problems.

## The POs are published and disseminated

The Program Outcomes are published and disseminated as follows

How Published	Where Published	How Disseminated
<b>Incorporated in the materials given to the students</b>	<ul style="list-style-type: none"> <li>• Lesson Plan</li> <li>• Course files and lab manuals</li> <li>• Laboratories in the departments</li> </ul>	<ul style="list-style-type: none"> <li>• Distribution and explanation to students on orientation day</li> <li>• Discussed in the introduction classes</li> <li>• Distributed along with course materials and lab manuals</li> </ul>
<b>Banner</b>	<ul style="list-style-type: none"> <li>• Classrooms/Laboratories</li> <li>• Office of the department</li> <li>• Department Notice boards</li> <li>• Staff Rooms</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reading by students, parents and alumni</li> </ul>
<b>Digital Media</b>	<ul style="list-style-type: none"> <li>• Institute Website: <a href="http://www.ifet.ac.in">www.ifet.ac.in</a></li> </ul>	<ul style="list-style-type: none"> <li>• Available for Self-reading in public domain</li> </ul>

Table 3.1: PO publishing and dissemination

## The Process for Establishing the PEOs and PSOs

The PEOs and PSOs are established through the following process steps:

The Vision, Mission of the Institution and Department along with the twelve Graduate Attributes is used in defining the PSOs.

**Step 1:** The Program Assessment Cell consults the key constituents: faculty and collects their views and prepares the draft version of the PEOs and PSOs.

**Step 2:** It also gathers views from the Alumni, Professional Body representatives, Industry representatives / Employer along with the faculty and revise the draft.

**Step 3:** The Program Assessment Cell then analyzes and express its opinion on the revised PEOs and PSOs and forwards the same for final approval to Department Advisory Board.

**Step 4:** Department Advisory Board deliberates on the views expressed by the Program Assessment Cell and finalises the accepted views based on which PSOs are to be established.

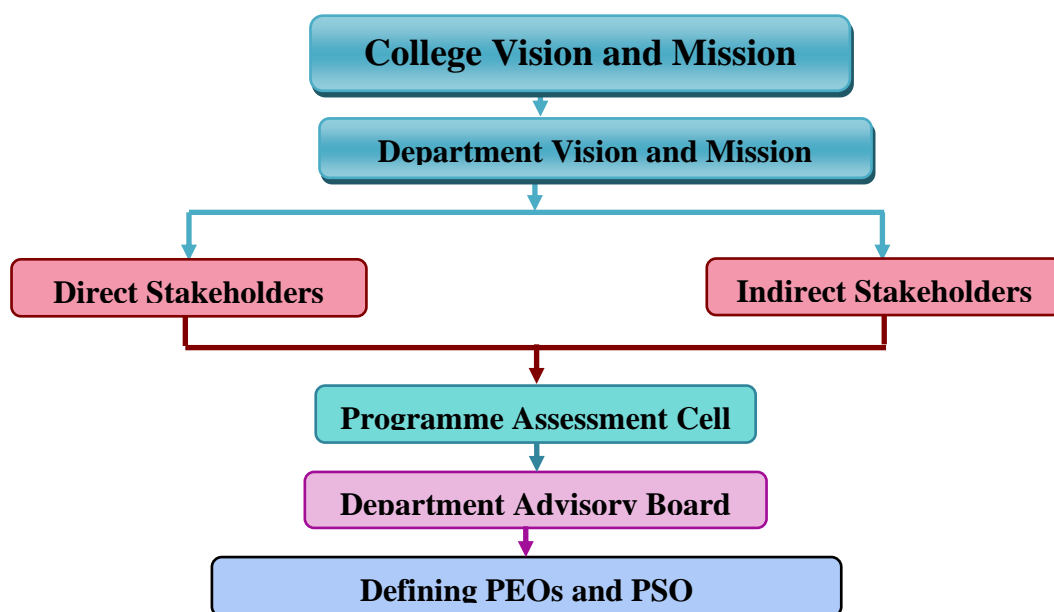


Fig 3.1 : Process of Establishing PEOs and PSOs



## 4. BLOOM'S TAXONOMY

Bloom's Taxonomy was created in 1956 under the leadership of educational psychologist Dr Benjamin Bloom in order to promote higherforms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts. It is most often used when designing educational, training, and learning processes.

### Bloom's Taxonomy Action Verbs

Domains	Keywords	Example
<b>Remembering:</b> Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Choose, Define, Describe, Find, How, Label, List, Match, Name, Omit, Recall, Recognize, Relate, State, Select, Show, Spell, Tell, What, When, Where, Which, Who, Why	<ul style="list-style-type: none"> <li>• State a Theorem , law or rule</li> <li>• Recite a poem.</li> <li>• Recollect a policy</li> <li>• Quote Prices or values from memory</li> </ul>
<b>Understanding:</b> Comprehending the meaning, translation, of instructions and problems. Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas in one's own words.	Classify, Compare, Comprehend, Contrast, Convert, Demonstrate, Distinguish, Explain, Extend, Generalize, Illustrate, Infer, Interpret, Outline, Relate, Rephrase, Show, Summarize, Translate	<ul style="list-style-type: none"> <li>• Rewrite the principles of test Writing.</li> <li>• Explain in one's own words the steps for performing a complex task.</li> <li>• Translate an equation into a Computer spreadsheet.</li> </ul>
<b>Applying:</b> Apply the knowledge, facts, techniques and rules learned in the classroom to find solutions in different and novel situations.	Apply, Build, Change, Choose, Compute, Construct, Demonstrate, Develop, Experiment with, Identify, Interview Manipulate, Make use of, Model, Modify, Organize, Operate, Plan, Prepare, Produce, Relate, Select, Show, Solve, Use /Utilize	<ul style="list-style-type: none"> <li>• Use a manual to calculate an employee's remuneration.</li> <li>• Apply the laws of statistics to evaluate the reliability of a written test.</li> </ul>

<p><b>Analyzing:</b> Examine and break information, materials or concepts into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.</p>	<p>Analyze, Appraise, Breakdown, Assume, Categorize, Classify, Compare, Conclusion, Contrast, Criticize, Defend, Differentiate, Discriminate, Discover, Dissect, Distinguish, Divide, Examine, Evaluate, Function, Infer, identify, illustrate, Inspect, Justify, List, Motive, Outline, Relationships, Select, Separate, Simplify, Survey, Support, Summarise, Take part in, Test for.</p>	<ul style="list-style-type: none"> <li>• Troubleshoot a piece of equipment by using logical deduction</li> <li>• . Recognize logical fallacies in reasoning.</li> <li>• Gather information from a department and select the required tasks for training.</li> <li>• Select the most effective solution.</li> <li>• Hire the most qualified candidate.</li> <li>• Explain and justify a new budget.</li> </ul>
<p><b>Creating:</b> Build a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning, structure or proposing alternative solutions</p>	<p>Adapt, Build, Change, Choose, Categorize, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Rearrange, Reconstruct, rewrite, reorganize, Solve, Test,</p>	<ul style="list-style-type: none"> <li>• Write a company operations or process manual.</li> <li>• Design a machine to perform a specific task.</li> <li>• Integrates training from several sources to solve a problem. Revises and process to improve the outcome.</li> </ul>

Table 3.1: Bloom’s Taxonomy Action Verbs

# Bloom's Taxonomy

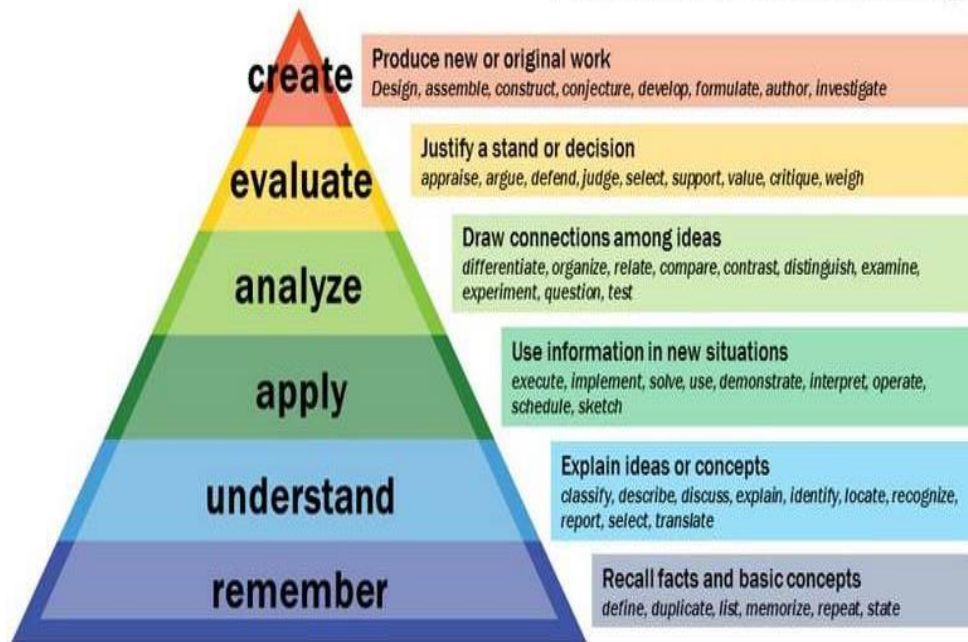


Fig 3.2 : Bloom's Taxonomy in a nutshell

## 5. COURSE OUTCOME STATEMENT

### Course Outcomes (COs):

Statements indicating what a student can do after the successful completion of a course. Every Course leads to some Course Outcomes. The CO statements are defined by considering the course content covered in each module of a course. For every course there may be five COs. The keywords used to define COs are based on Bloom's Taxonomy.

### SAMPLE CO STATEMENTS:

Course: **THEORY OF COMPUTATION**

Course Code: **19UCSPC502**

**Table 6.1:** Sample CO statements

Upon successful completion of this course, students should be able to

	<b>COURSE OUTCOMES</b>
C303.1	Construct automata, regular expression for any pattern
C303.2	Identify the given automata and to represent its minimized form
C303.3	Illustrate the equivalence of Pushdown Automata and Context Free grammar
C303.4	Propose computation solutions using Turing machines
C303.5	Comprehend that not all problems are solvable by computers and some problems do not admit efficient algorithms

## 6. CO – PO AND CO – PSO MAPPING OF COURSES

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

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

### Levels of Outcomes

There are four levels of outcome such as Course Outcome (CO), Program Outcome (PO), Program Specific Outcome (PSO) and Program Educational Objective (PEO). Course Outcomes are the statements that declare what students should be able to do at the end of a course. POs are defined by Accreditation Agencies of the country (NBA in India), which are the statements about the knowledge, skills and attitudes, graduate attributes of a formal engineering program should have. Graduates Attributes (GAs) are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. GAs form a set of individually assessable outcomes of the program. The NBA laid down the graduate attributes relating to program outcomes and is to be derived by program.

The Program outcomes reflect the ability of graduates to demonstrate knowledge in fundamentals of Basic Sciences, Humanities and Social Sciences, Engineering Sciences and apply these principles in understanding and practically apply the knowledge in professional core subjects, electives and projects which enables the graduates to be competent at the time of graduation. The graduates must adhere to professional and ethical responsibilities in the pursuit of their careers and also for the benefit of the society. These outcomes also enable the graduate to pursue higher studies and engage in R&D for a successful professional career.

The proper definition and the attainment of POs contribute to the attainment of Program Educational Objectives which will help the graduate to perform his/ her duties, professional responsibilities, design, development, production and testing of novel

products, ability to deal with finances and project management during his/her early professional career of 3 to 4 years.

Program Specific Outcomes are the statements that assert what the graduates of a specific engineering program should do what they can able to do. Program Educational Objectives are the broad statements which describe in detail about the career and professional accomplishments after significant years of graduation that the program prepares the graduates to achieve.

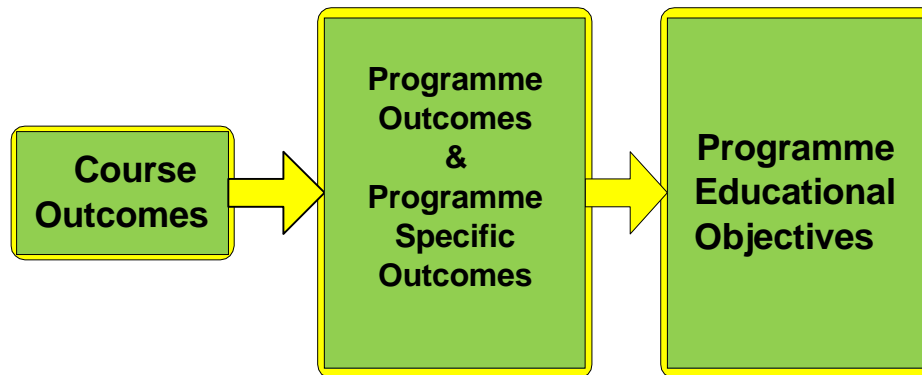


Figure 6.1: Relating the outcomes (CO-PO&PSO-PEO)

After CO statements are developed by the course in-charge, CO will be mapped with the appropriate PO's based on the relationship that exist between them. If the PO's are not necessarily mapped with any one CO and it may be left blank. However, it is mandatory that all POs should be mapped with any one of PSO and PEO which are specified in the program. This is shown in figure 6.2.

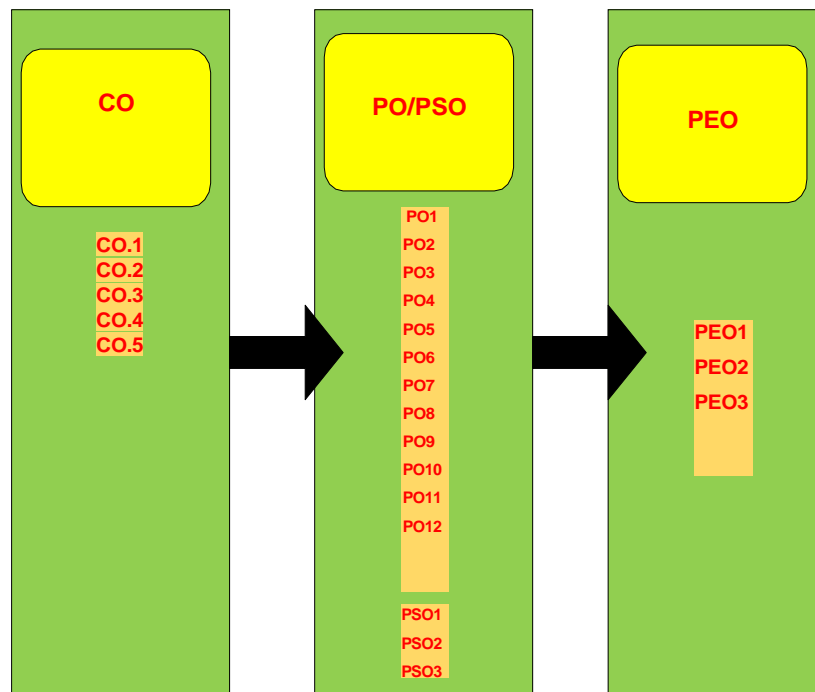


Figure 6.2 : Relationship between CO, PO & PSO and PEO

### **SAMPLE CO-PO AND CO-PSO MAPPING:**

Course: **THEORY OF COMPUTATION**

Course Code: **19UCSPC502**

Mapping of CO with PO

The course outcomes should be named after the year and semester and the chronological order in which the course is appearing in the syllabus book. C204.1 is the fourth course in second year first semester. A sample course outcome statements and sample CO-PO matrix are given in Table 6.1 based on CO statements.

The CO-PO mapping has been done with correlation levels of 3, 2, 1 and '-'. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The meaning of '-' is no correlation between CO and PO.

Course Outcomes TOC(19UCSPC502)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C303.1	3	3	3	-	-	-	-	-	-	-	-	-
C303.2	2	3	-	-	-	-	-	-	-	-	-	-
C303.3	2	3	2	-	-	-	-	-	-	-	-	-
C303.4	-	3	2	-	-	-	-	-	-	-	-	-
C303.5	-	3	-	-	-	-	-	-	-	-	-	-
Average CO(TOC)	1.4	3	1.4	-	-	-	-	-	-	-	-	-

Table 6.1: Sample CO-PO Matrix

Course Outcomes TOC(19UCSPC502)	PSO1	PSO2	PSO3
C303.1	3	-	-
C303.2	3	-	-
C303.3	2	1	-
C303.4	2	1	-
C303.5	2	-	-
Average CO(TOC)	2.4	0.4	-

Table 6.2: Sample CO-PSO Matrix

**Assessment tools:**

## (i) Direct Assessment Tools:

Direct assessment tools are used for the direct assessment of POs and PSOs. Initially, the attainment of each course outcome is determined using internal as well as external (university exam) assessment. The each PO attainment of corresponding to a particular course is determined from the attainment values obtained for each course outcome related to that PO and the CO-PO mapping values. Similarly, the values of PSO attainment are also determined.



(ii) Indirect Assessment Tools:

Indirect assessment is done through Course End Survey, Program exit survey, Alumni survey and Employer survey.

Supplement the above explanation to the Excel sheet given for evaluating the CO's, PO's and PSO's. All the outcomes are set for a 3 point scale. There are formula and target values of attainment. Please do not change the formula in the Excel sheet as you may get wrong values. Set the target values as per your decision. The number of students may vary for each class. Delete the excess rows from the bottom of the sheet.

THANK YOU !