



“Empowerment through quality technical education”
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CO-PO-PSO

ASSESMENT AND ATTAINMENT PROCESS MANUAL



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1. INSTITUTE VISION AND MISSION

Vision:

“Empowerment through quality technical education”

Mission:

M1: To excel as a center of excellence in technical education

M2: To impart skill based education to meet the needs of industry and Society

M3: To achieve excellence in teaching, learning and research

M4: To inculcate social & ethical values among the students

Quality Policy

We strive to impart the quality technical education through academic excellence and provide best of facilities to satisfy the need & expectations of the students & stakeholders.

2. DEPARTMENT VISION AND MISSION

Vision:

Imparting quality technical education to meet the needs of industry & society

Mission:

- To create center of learning through an integrated, interdisciplinary approach
- To impart employability skill among students
- To establish Industry linkages

Program Specific Objectives (PSO's)

A graduate will

- **PSO 1:** Understand the fundamentals of designing electronic systems for applications like communication systems, signal processing, embedded and VLSI systems and automation.
- **PSO 2:** Strengthen the ability to use open source tools for modeling and simulation to solve technical problems.
- **PSO 3:** Inculcate the skills to manage and lead a team contributing to development of prototype, application, and product in next generation technologies.

Program Educational Objectives (PEO's)

A graduate will

- **PEO 1:** Utilize interpersonal skills, technical knowledge for quality work with enthusiasm and commitment.
- **PEO 2:** Develop an ability to design a hardware/software/firmware to meet the globally accepted standards in technology.
- **PEO 3:** Be able to apply his/her skills in engineering and technology to become an entrepreneur.
- **PEO 4:** Engage in learning new technological and cultural challenges through life- long learning.
- **PEO 5:** Graduate will exhibit good citizenship, cultural harmony and skill in the welfare of society.

The Process for Defining Vision and Mission of the Department

The following steps are followed to establish Vision and Mission of Department

Step 1.The Vision & Mission of the Institute is taken as the basis.

Step 2: The Department conducts brain-storming sessions with the faculty on the skill-set required by the local and global employers, Industry Advances in Technology and R & D, and the draft copy of the Vision and Mission of the Department is drafted.

Step 3: The views from Parents, Professional Bodies, Industry representatives and Advisory Board on the draft are also collected and incorporated to revise the draft version based on their inputs.

Step 4: The accepted views are analyzed and reviewed to check the consistency with the vision and mission of the institute.

The process for defining department vision and mission are illustrated in the flow chart Figure 2.1.

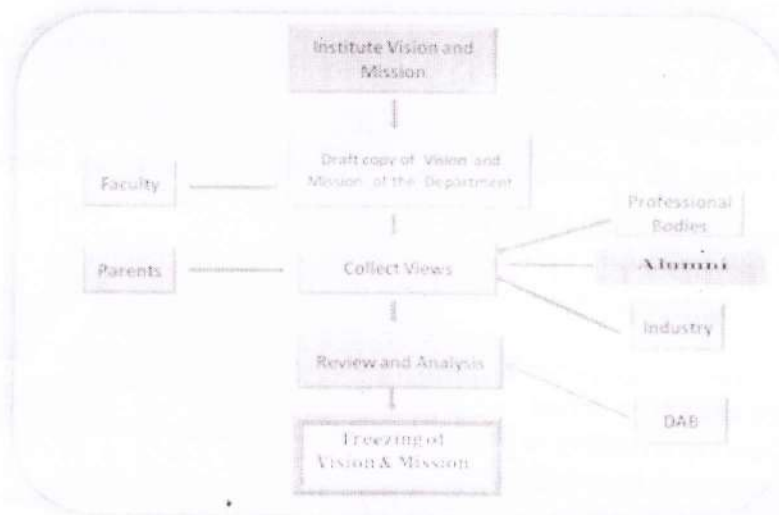


Figure 2.1 Process for defining Vision and Mission of the Department

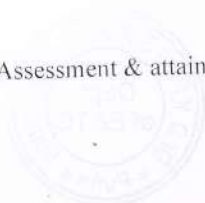
3. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes (POs):

Program outcomes describe what students are expected to know and would be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.

Program Specific Outcomes (PSOs):

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



4. STATEMENTS OF POs AND PSOs

PROGRAM OUTCOMES (POs):

| Program Outcomes | | |
|-------------------------|---|---|
| PO1 | Engineering knowledge | An ability to apply knowledge of mathematics(including probability, statistics and discrete mathematics), science, and engineering for solving Engineering problems and modeling |
| PO2 | Problem analysis | An ability to design, simulate and conduct experiments, as well as to analyze and interpret data including hardware and software components |
| PO3 | Design / development of solutions | An ability to design a complex electronic system or process to meet desired specifications and needs |
| PO4 | Conduct investigations of complex problems | An ability to identify, formulate, comprehend, analyze, design synthesis of the information to solve complex engineering problems and provide valid conclusions. |
| PO5 | Modern tool usage | An ability to use the techniques, skills and modern engineering tools necessary for engineering practice |
| PO6 | The engineer and society | An understanding of professional, health, safety, legal, cultural and social responsibilities |
| PO7 | Environment and sustainability | The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and demonstrate the knowledge need for sustainable development. |
| PO8 | Ethics | Apply ethical principles, responsibility and norms of the engineering practice |
| PO9 | Individual and team work | An ability to function on multi-disciplinary teams. |
| PO10 | Communication | An ability to communicate and present effectively |
| PO11 | Project management and finance | An ability to use the modern engineering tools, techniques, skills and management principles to do work as a member and leader in a team, to manage projects in multi-disciplinary environments |
| PO12 | Life-long learning | A recognition of the need for, and an ability to engage in, to resolve contemporary issues and acquire lifelong learning |



The POs are published and disseminated

The Program Outcomes are published and disseminated as follows,

Table 4.1: PO publishing and dissemination

| How Published | Where published | How Disseminated |
|--|--|--|
| <ul style="list-style-type: none"> Incorporating in booklet given in orientation, syllabus book, course files and lab manuals | <ul style="list-style-type: none"> Orientation booklet syllabus books Course files and lab manuals Laboratories in the departments | <ul style="list-style-type: none"> <input type="checkbox"/> Distribution and explanation to students on orientation day Displayed on the notice board <input type="checkbox"/> Discussed during student Counseling Distributed along with Syllabus books, course files and lab manuals |
| <ul style="list-style-type: none"> Flexis/ Notices | <ul style="list-style-type: none"> <input type="checkbox"/> Class rooms/ Laboratories <input type="checkbox"/> Office of the department <input type="checkbox"/> Department Notice boards <input type="checkbox"/> Staff Rooms | <ul style="list-style-type: none"> Self-reading by students, parents and alumni Displayed on the notice board |
| <ul style="list-style-type: none"> Digital Media | <ul style="list-style-type: none"> Institute Website ✓ www.dypsos.in | <ul style="list-style-type: none"> Available for Self-reading in public domain |

The Process for Establishing the PO's

The POs are established through the following process steps:

The Vision, Mission of the Department along with the 12 Graduate Attributes are given by the NBA are used in defining the POs.

Step 1: Head of the Department consults the key constituents: faculty and collects their views and prepares the draft version of the POs.

Step 2: Head of the Department then gather views from the Alumni, Professional Body representatives, Industry representatives / Employer along with the faculty and revise the draft.

Step 3: The CDC analyzes and express its opinion on the revised POs and forwards



the same for final approval to Department Advisory Board.

Step 4: Department Advisory Board deliberate on the views expressed by the CDC and formulate the accepted views based on which POs are to be established.

However, the views expressed by them were in line with the graduate attributes defined by NBA.

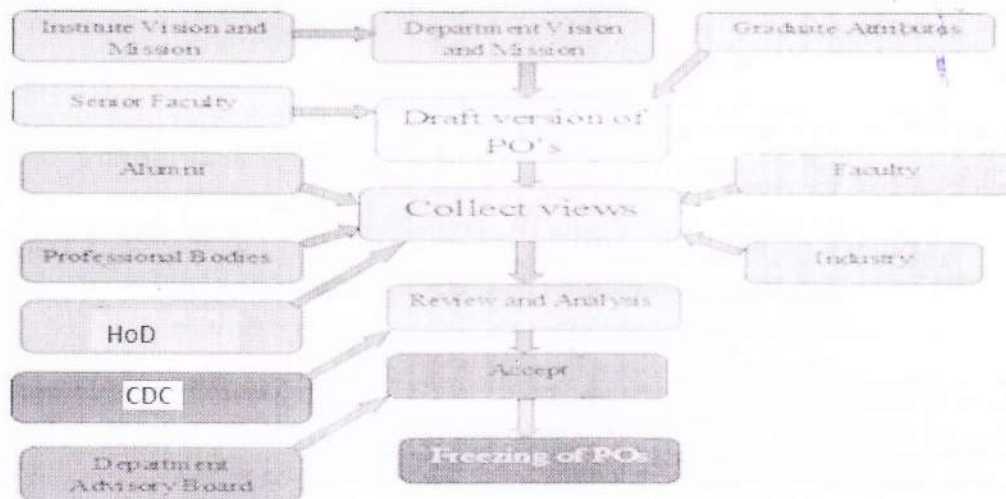


Fig . 4.2 Process to Define Program Outcomes of the Department

PROGRAM SPECIFIC OUTCOMES (PSOs):

The graduates of the department will attain:

PSO1: The ability to analyze, design and implement application specific electronic system for complex engineering problems for analog, digital domain, communications and signal processing applications by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.

PSO2: The ability to adapt for rapid changes in tools and technology with an understanding of societal and ecological issues relevant to professional engineering practice through life-long learning.



PSO3: Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.

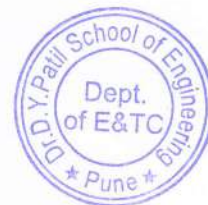
5. BLOOM'S TAXONOMY

Bloom's Taxonomy was created in 1956 under the leadership of educational psychologist Dr Benjamin Bloom in order to promote higher forms 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 | | |
|--|--|---|
| Domains | Keywords | Example |
| Remembering: Recall or retrieve previous learned information. | defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states | Recite a policy. Quote prices from memory to a customer. Recite the safety rules. |
| Understanding: Comprehending the meaning, translation, interpolation, and interpretation of instructions and | comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, | Rewrite the principles of test writing. Explain in one's own words the steps for performing a complex task. |



| | | |
|---|---|---|
| problems. State a problem in one's own words. | summarizes, translates | Translate an equation into a computer spreadsheet. |
| Applying: Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place. | applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses | Use a manual to calculate an employee's vacation time. Apply laws of statistics to evaluate the reliability of a written test. |
| Analyzing: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences. | analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates | Troubleshoot a piece of equipment by using logical deduction. Recognize logical fallacies in reasoning. Gathers information from a department and selects the required tasks for training. |
| Evaluating: Make judgments about | appraises, compares, concludes, contrasts, | Select the most effective solution. |
| the value of ideas or materials. | criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, | Hire the most qualified candidate. Explain and justify a new budget. |



| | | |
|---|---|---|
| | justifies, relates, summarizes, supports | |
| Creating: Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure. | categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes | Write a company operations or process manual. Design a machine to perform a specific task. Integrates training from several sources to solve a problem. Revises and process to improve the outcome. |

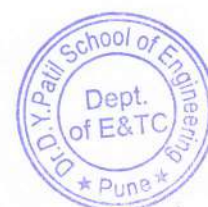
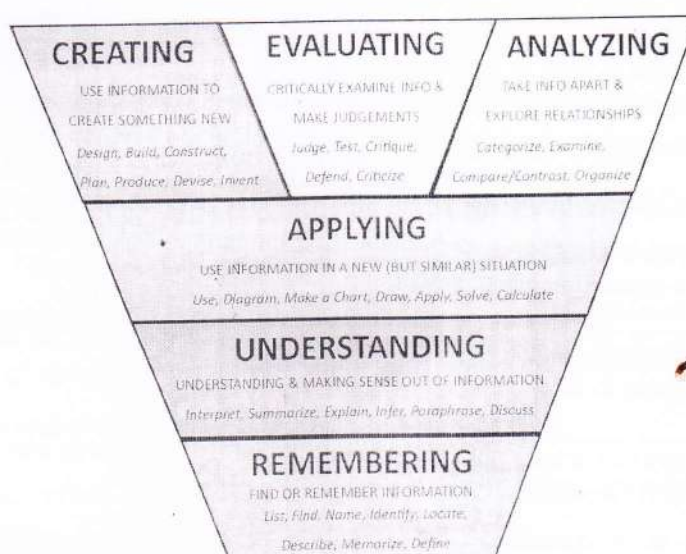


Figure 5.1 Pictorial representation of Blooms Taxonomy

6. 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 5 or 6 COs. The keywords used to define COs are based on Bloom's Taxonomy.

SAMPLE CO STATEMENTS:

Course: Engineering Mathematics III

Course Code: 207001

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

Table 6.1: Sample CO statements

| CO | COURSE OUTCOMES DESCRIPTION |
|-----|---|
| CO1 | Solve higher order linear differential equations and apply to civil engineering problems such as bending of beams and whirling of shafts. |
| CO2 | Solve system of linear equations using direct and iterative numerical techniques and develop solutions to ordinary differential equations using single step and multi step methods applied to structural systems. |
| CO3 | Apply statistical methods like correlation, regression analysis in analyzing and interpreting experimental data and probability theory applied to construction management. |
| CO4 | Perform vector differentiation and integration, analyze the vector fields and apply to fluid flow problems. |
| CO5 | Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations. |



| | |
|-----|---|
| CO6 | <ul style="list-style-type: none"> Faculty members can create their extra Cos if not mentioned in the SPPU syllabus. |
|-----|---|

7. 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

7.1 Levels of Outcomes

There are three levels of outcome such as Course Outcome (CO), Program Outcome (PO), Program Specific Outcome (PSO).

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 potential to acquire competence to practice at the appropriate level. GAs form a set of individually assessable outcomes of the programme. The NBA laid down the graduate attributes relating to programme 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 prepare the graduates to achieve.

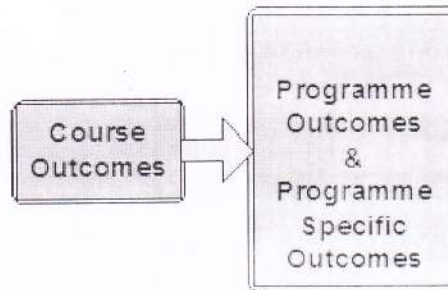


Figure 7.1: Relating the outcomes (CO-PO&PSO-PEO)

Figure 7.1 shows the building block of CO-PO&PSO-PEO relationship. After CO statements are developed by the course in-charge, CO will map with any possible PO's based on the relationship exist between them. But the PO's are not necessarily mapped with any one CO and it may be left blank. Anyhow, 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 7.2.

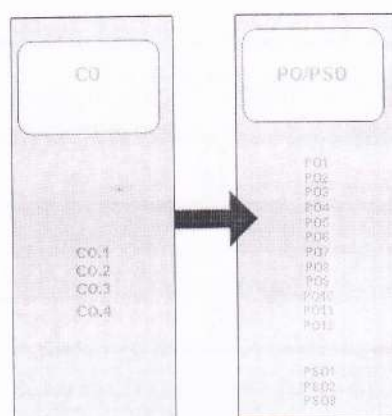


Figure 7.2 : Relationship between CO, PO & PSO and PEO

7.2 Process involved in CO-PO Mapping

The role of CO-PO mapping will be assigned to the faculty as per hierarchy followed in figure 7.3. After the course (subject) allotment from the department, the course in-charge of the course has to write appropriate COs for their corresponding course. It should be narrower and measurable statements. By using the action verbs of learning levels, CO's will be designed. CO statements should describe what the students are expected to know and able to do at the end of each course, which are related to the skills, knowledge and behavior that students will acquire through the course.

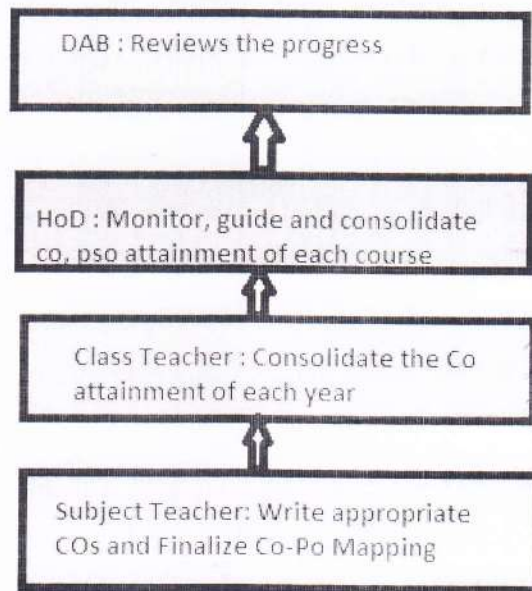


Figure 7.3: Hierarchy of faculty involvement

After writing the CO statements, CO will be mapped with PO of the department. If the department is having more than one section in a year or the same course is available for more than one program of the same institute in a semester, the subject expert will be nominated as course coordinator of the corresponding course. The role of the course coordinator is to review the CO statements and the CO-PO mapping which has been done by course in-charge. The year wise coordinator has to consolidate the CO's of the respective year and maintain the documentation of the CO attainment level of the respective year courses as well as documentation of the individual students extra-curricular and co-curricular activities. These details will hand over to the program coordinator in order to evaluate PO attainment of the individual student as well as individual course at the end of the eighth semester. The Program coordinator has to evaluate the PO attainment of individual student through direct and indirect method after the student completing their program. All these works have to be done under the guidance of Department Advisory Board (DAB).

7.3 SAMPLE CO-PO AND CO-PSO MAPPING:

A sample course outcome statements and sample CO-PO matrix are given in Table 7.1, based on CO statements given in table 6.1.



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.

Table 7.1: Sample CO-PO Matrix

| | | CO-PO-PSO Mapping | | | | | | | | | | | | | | |
|---------|--------------|-------------------|------|------|------|------|------|------|-----|-----|------|------|------|------|------|------|
| PO | BT LEVEL | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO | | | | | | | | | | | | | | | | |
| CO-1 | 3-Apply | 3 | | 1 | | | 2 | 3 | | | | 1 | 2 | 1 | | 2 |
| CO-2 | 4-Analyze | 3 | 2 | | | | 1 | 2 | | | | | 1 | 1 | | |
| CO-3 | 3-Apply | 3 | 3 | 1 | 2 | | | | | | | | | 1 | | 3 |
| CO-4 | 2-Understand | 3 | 2 | 2 | | 1 | 1 | 2 | | | | | 1 | 2 | | |
| CO-5 | 3-Apply | 2 | | | | | | | | | | | 2 | 1 | 1 | |
| CO-6 | 2-Understand | 3 | | 2 | 1 | | 1 | 1 | | | | | 1 | 2 | | |
| Average | | 2.83 | 2.33 | 1.50 | 1.50 | 1.00 | 1.25 | 2.00 | - | - | - | 1.00 | 1.40 | 1.33 | 1.00 | 2.50 |
| Rounded | | 3 | 3 | 2 | 2 | 1 | 2 | 2 | | | | 1 | 2 | 2 | 1 | 3 |

(Strength of Correlation): 3-Strong, 2-Medium, 1-Weak, Keep Blank-if No Correlation

7.4 PROCESS USED TO IDENTIFY THE CURRICULAR GAPS TO THE ATTAINMENT OF COS/POS

The process used to identify the curricular gaps to the attainment of COs/POs is given in figure 7.3 and is explained as below:

Step-1:

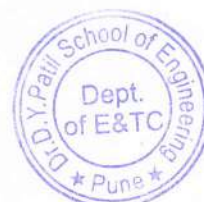
The course handling faculty, after CO-PO mapping, would submit CO attainment to Course coordinator.

Step-2:

The course coordinator would submit the CO-PO attainment along with curriculum gap identified in the course and recommendations to conduct co-curricular activities & identify content beyond the syllabus to Year wise coordinator.

Step-3:

The year wise coordinators who are the members of the PAC would consolidate the CO attainment of the respective year along with curricular gaps and recommendations to conduct co-curricular activities reported by course coordinators.



Step-4:

The PAC would consolidate the CO and PO attainment of the programme with all the identified gaps and submit report to DAB.

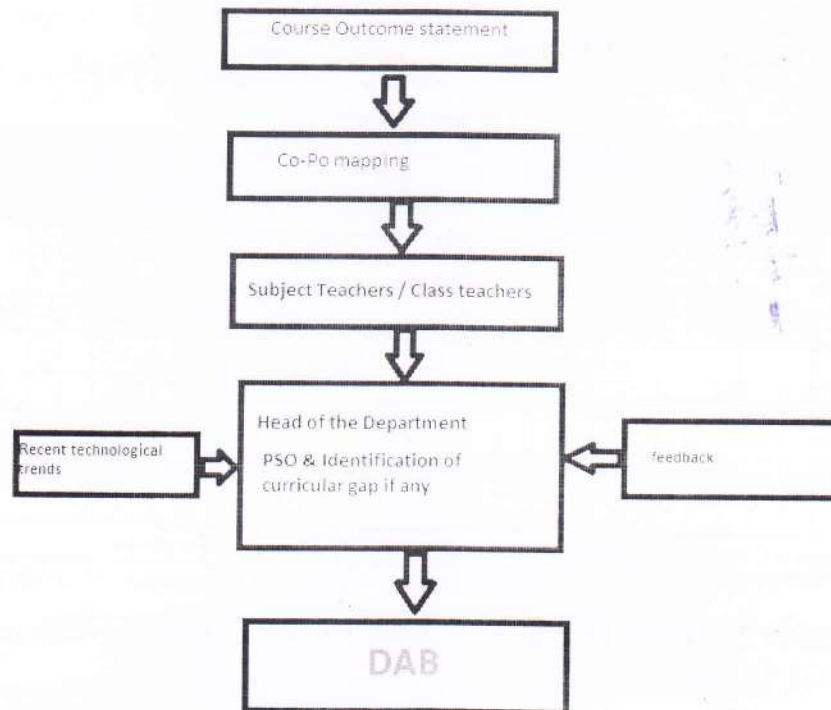


Figure 7.3: Identification of curricular gap

Program Assessment Committee after getting prior approval from DAB about the steps to be taken to bridge the curricular Gap and content beyond the syllabus may be delivered to the students through teaching, arranging guest lectures, industrial visit, in plant training, online quiz, etc.

8. COURSE OUTCOMES TO PO AND PSO MAPPING

Mapping strength of a course to PO/ PSO can be obtained by taking the average of the CO-PO/ PSO mapping matrices of that course.

SAMPLE COURSE-PO AND COURSE-PSO MAPPING

Course: ELECTRONIC CIRCUITS



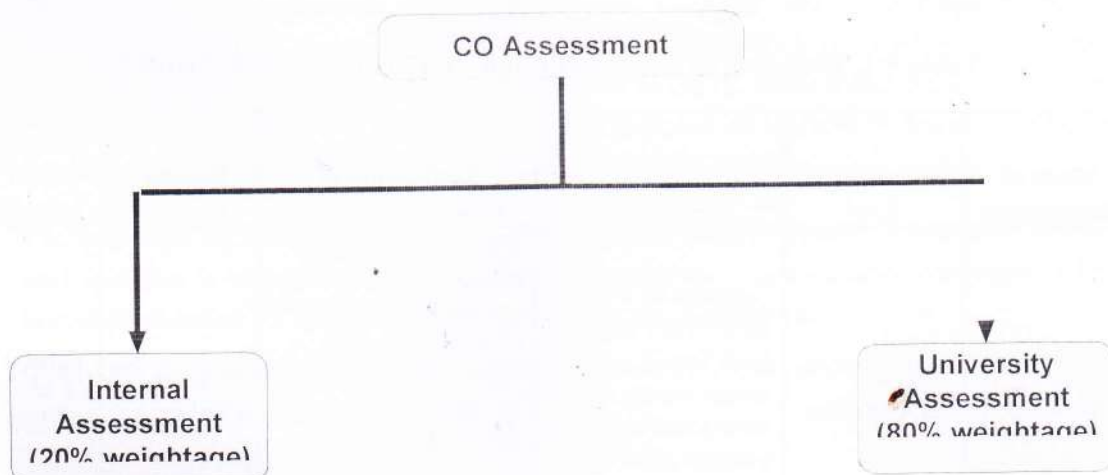
| PO CO | BT LEVEL | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-------------|--------------|------|------|------|------|------|-----|-----|-----|-----|------|------|------|------|------|------|
| CO-1 | 1-Remember | 3 | 1 | | | | | | | | | | | 1 | | |
| CO-2 | 6-Create | 2 | 2 | 3 | 1 | | | | | | | | | 3 | 2 | 1 |
| CO-3 | 4-Analyze | 1 | 3 | 1 | | 1 | | | | | | | | 3 | 1 | 1 |
| CO-4 | 2-Understand | 3 | | | | | | | | | | | | 1 | | |
| CO-5 | 6-Create | 3 | 2 | 1 | | | | | | | | | | 3 | 2 | 1 |
| CO-6 | 2-Understand | 2 | 1 | 1 | | | | | | | | | | 1 | | |
| Average | | 2.33 | 1.80 | 1.50 | 1.00 | 1.00 | - | - | - | - | - | - | - | 2.00 | 1.67 | 1.00 |
| Rounded off | | 3 | 2 | 2 | 1 | 1 | | | | | | | | 2 | 2 | 1 |

9. ASSESSMENT PROCESS

9.1 Assessment Process for CO Attainment:

For the evaluation and assessment of CO's and PO's, rubrics are used. The rubrics considered here are given below:

(i) CO Assessment Rubrics:



the predefined targets, if is not the course coordinator takes necessary steps for the improvement to reach the Course Outcome is evaluated based on the performance of students in internal assessments and in university examination of a course. Internal assessment contributes 20% and university assessment contributes 80% to the total attainment of a CO.

(ii) CO Assessment Tools:

The description of Assessment tools used for the evaluation of program outcomes is given in Table 9.1. The various assessment tools used to evaluate COs and the frequency with which the assessment processes are carried out are listed in table 9.2.

In each course, the level of attainment of each CO is compared with target. With the help of CO against PO/PSO mapping, the PO/PSO attainment is calculated by the programme coordinator.

Table 9.1: Mapping of assessment tools to POs/PSOs with frequency

| Mode of Assessment | Assessment Tool | Description | Evaluation of Course Outcomes | Related POs/PSOs | Frequency of assessment |
|--------------------|----------------------|--|---|------------------|--------------------------|
| Direct | Internal Examination | Summative Test, Unit Test 1 and Unit Test 2 examinations are conducted and its average marks are considered. | The questions in the internal examinations are mapped against COs of respective course. The questions for three internal examinations are framed in such a way to cover all of the course outcomes. | PO 1 PO 12 | Three exams per Semester |



| | | | | | |
|----------|-----------------------|--|---|---------------|---------------------------|
| | Continuous Assessment | Assignment, Quiz, Internal Viva, Presentations/ Seminars, Internal practical examination are conducted and its marks are considered. | Assignments and quiz questions are mapped against COs of the respective course. The questions for internal practical examinations are framed in such a way to cover all of the Lab course outcomes. | PO 1 to PO 12 | Continuous |
| Indirect | Course Exit Survey | This survey gives the opinion of the student on the attainment of course outcomes. | At the end of the course a survey is collected from students and its considered for the CO attainment under Indirect assessment. | PO 1 to PO 12 | At the end of each course |

(iii) Quality/Relevance of Assessment Process:

Theory:

(A) Internal Assessment:

Internal Examination- Direct

Internal tests serve to encourage students to keep up with course content covered in class. Three internal examinations are conducted per semester and its average marks are considered. Unit test -1 – summative test is of 20 Marks which is based on Unit 1 and it covers CO1. Unit Test -2 is of 20 marks which is based on Units 2 and 3 and it will cover COs 2 and 3. Unit Test-3 is of 30 Marks which is based on Units 4, 5, 6 and it will cover COs 4,5,6 respectively.

The questions are framed in such a way that it should satisfy Bloom's Taxonomy, wherein each question is mapped to the appropriate course outcome of the respective course, which is evaluated based on the set attainment levels by the department.

Questions framed will be theory questions and written examination will be conducted in each department as per set time table.

Continuous Assessment- Direct

Assignments / quiz-

This includes Assignment, Quiz, Internal Viva, Presentations/Seminars, Internal practical examinations. This assessment is of 25 Marks and this assessment is carried out throughout the semester. This mark distribution will be based on nature of the course, structure of Lab work, students regularity, mode of conduction of practical and quality of submitted of lab journals/assignments/quiz/presentations etc.

The questions of assignments and quiz are framed in such a way that it should satisfy Bloom's Taxonomy, wherein each question is mapped to the appropriate course outcome of the respective course, which is evaluated based on the set attainment levels by the department.

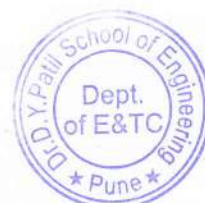
Internal Practical Examination-

Lab courses provide students first-hand experience with course concepts and the opportunity to explore methods used in their discipline. All the students are expected to be regular and learn the practical aspects of the subject and develop the necessary skills to become professionals. In order to facilitate interaction among the students and to develop team spirit, the students are expected to carry out experiments in groups. Performance assessment is based on the ability of the student to actively participate in the successful conduct of prescribed practical work and draw appropriate conclusions. The student submits a record of practical work performed in each lab session. For practical subjects there shall be a continuous evaluation during a semester. For internal evaluation, day-to-day work in the laboratory shall be evaluated and internal practical examination shall be conducted and evaluated by the laboratory teacher concerned.

Seminar

For the seminar presentation, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of head of the department, seminar supervisor and a senior faculty member. There shall be no external examination for the seminar. The committee evaluates seminar based on following parameters.

| Assessment Tool | |
|--------------------------------|--------------|
| Internal Assessment | Presentation |
| | Viva-voce |
| | Report |



Presentation: The content, quality of the presentation and communication skill is assessed by the evaluation committee.

Viva-voce: At the end of the presentation, the assessment panel and the student audience ask questions and seek clarifications on specific issues related to the seminar. The effectiveness of the student's response to these queries is assessed.

Report: A bona fide report on seminar is submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. A students' ability to comprehend and write effective reports and design documentation is assessed by evaluating the report.

Course exit survey- Indirect

At the conclusion of each semester, department will conduct a course exit survey for all the subjects taught in that semester. Students will map the CO of each Unit given as per syllabus to the syllabus covered in the classroom. Students will mark their responses in the course exit survey questionnaire and it shall be on the scale of 1 to 3 as.

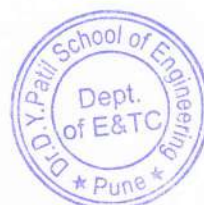
- 1: Slightly Understood ,
- 2: Moderately Understood
- 3: Clearly Understood

(B) University Assessment- Direct

Savitribai Phule Pune University (SPPU) will be conducting all the University examinations which includes In-Sem examination of 30 marks, End Sem examination of 70 Marks, Practical examination, and project examination where marks are as per course structure.

(iv) Attainment Levels:

Course outcomes of all courses are assessed with the help of above mentioned assessment tools and attainment level is evaluated based on set attainment rubrics as per table 9.2. If the average attainment of a particular course for two consecutive years is greater than 80% of the maximum attainment value (i.e. 80% of 3 = 2.4), then for that particular course the current rubrics for



attainment must be changed to analyse continuous improvement.

Table 9.2. Attainment Levels of Cos

| Assessment Methods | Attainment Levels | |
|---------------------|-------------------|--|
| Internal Assessment | Level 1 | 60% of students scoring more than 40% marks in internal assessment tools |
| | Level 2 | 70% of students scoring more than 40% marks in internal assessment tools |
| | Level 3 | 75% of students scoring more than 40% marks in internal assessment tools |

| | | |
|-----------------------|---------|--|
| University Assessment | Level 1 | 60% of students scoring more than 40% marks in university examination. |
| | Level 2 | 70% of students scoring more than 40% marks in university examination. |
| | Level 3 | 75% of students scoring more than 40% marks in university examination. |

Validation of CO-PO mapping

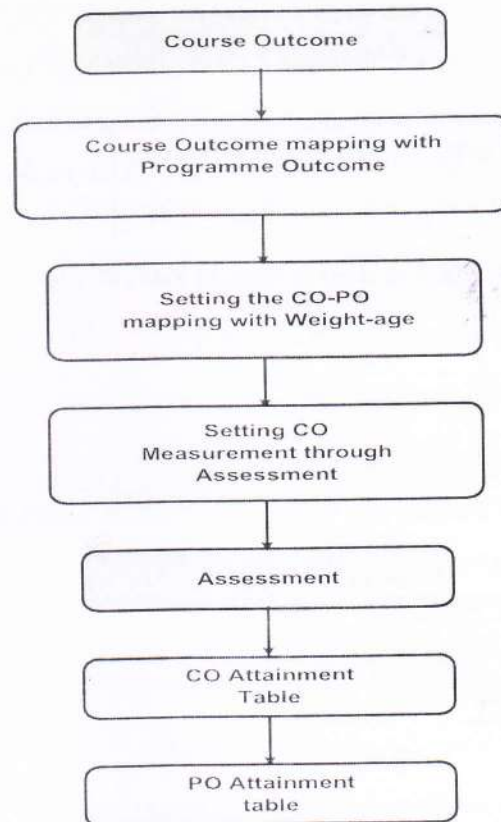


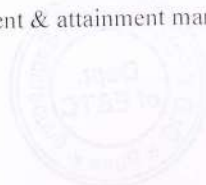
Figure 9.1: The process of CO-PO mapping validation

The process of CO-PO mapping validation is given in figure 9.1 and is explained as below:

- Step 1 : Obtain course outcome.
- Step 2 : Mapping of course outcome with program outcome.
- Step 3 : Setting weightage for CO assessment.
- Step 4 : CO measurement through assessment.
- Step 5 : Obtain CO attainment table through direct and indirect assessment methods.
- Step 6 : Obtain PO attainment table through direct and indirect assessment methods.

Assessment and Attainment methods

Assessment is one or more processes which is carried out by the institution, that identify, collect and prepare data to evaluate the achievement of course outcomes and program outcomes. Attainment is the action or fact of achieving a standard result towards accomplishment of desired



goals. Primarily attainment is the standard of academic attainment as observed by test and/or examination result. Assessment methods are categorized into two as direct method and indirect method to assess CO's and PO's. The direct methods display the student's knowledge and skills from their performance in the continuous internal assessment tests, semester examinations and supporting activities such as seminars, assignments, case study, group discussion, online quiz, mini project etc., These methods provide a sampling of what students know and/or can do and provide strong evidence of student learning. The indirect method done through surveys and interviews, it asks the stakeholders to reflect their views on student's learning. The institute assesses opinions or thoughts about graduate's knowledge or skills by different stakeholders.

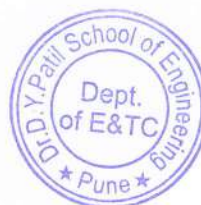
CO assessment methods are employed

- Direct assessment method and indirect assessment method are considered for 80% and 20% weightages respectively.
- Internal test assessment and end semester examination assessment are considered with the weightage of 30% and 70% respectively for the direct assessment of CO.

a. Procedure for Attainment of Program Outcomes

At the end of the each programme, the PO/PSO assessment is done from the CO attainment of all curriculum components. As per NBA guidelines, program can appropriately define the attainment level. The attainment level may be set by the particular program or commonly by the institution. The attainment can be made as best the choice by the institution or the program by analyzing the students knowledge. This can be achieved by using different supporting activities. This attainment is mainly for the purpose of making an esteemed engineer with good analytical, practical and theoretical knowledge about the program by attaining PSO's of the program and the institution. For the evaluation and assessment of CO's and PO's, rubrics are used. The rubrics considered here are given below:

Attainment Level 1: 60% of students score more than 40% marks out of the maximum relevant marks. Attainment Level 2: 70% of students score more than 40% marks out of the maximum



relevant marks. Attainment Level 3: 75% of students score more than 40% marks out of the maximum relevant marks.

| Assessment Methods | Attainment Levels | |
|---------------------|-------------------|--|
| Internal Assessment | Level 1 | 60% of students scoring more than 40% marks in internal assessment tools |
| | Level 2 | 70% of students scoring more than 40% marks in internal assessment tools |
| | Level 3 | 75% of students scoring more than 40% marks in internal assessment tools |

| Assessment Methods | Attainment Levels | |
|----------------------------------|-------------------|--|
| University (External) Assessment | Level 1 | 60% of students scoring more than 40% marks in internal assessment tools |
| | Level 2 | 70% of students scoring more than 40% marks in internal assessment tools |
| | Level 3 | 75% of students scoring more than 40% marks in internal assessment tools |

b. CO Attainment Calculation of a Course:

Overall CO attainment of a course must be prepared as shown below



Mapping of Course outcome with Program Outcomes

Course: ELECTRONIC CIRCUITS

| PO CO | BT LEVEL | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-------------|--------------|------|------|------|------|------|-----|-----|-----|-----|------|------|------|------|------|------|
| CO-1 | 1-Remember | 3 | 1 | | | | | | | | | | | 1 | | |
| CO-2 | 6-Create | 2 | 2 | 3 | 1 | | | | | | | | | 3 | 2 | 1 |
| CO-3 | 4-Analyze | 1 | 3 | 1 | | 1 | | | | | | | | 3 | 1 | 1 |
| CO-4 | 2-Understand | 3 | | | | | | | | | | | | 1 | | |
| CO-5 | 6-Create | 3 | 2 | 1 | | | | | | | | | | 3 | 2 | 1 |
| CO-6 | 2-Understand | 2 | 1 | 1 | | | | | | | | | | 1 | | |
| Average | | 2.33 | 1.80 | 1.50 | 1.00 | 1.00 | - | - | - | - | - | - | - | 2.00 | 1.67 | 1.00 |
| Rounded off | | 3 | 2 | 2 | 1 | 1 | | | | | | | | 2 | 2 | 1 |

CO-PO attainment of the course ELECTRONIC CIRCUITS

Internal attainment of each COs of EC is the average of attainments obtained using various internal assessment tools. University exam covers the entire syllabus of a course and hence it is useful to measure the attainment of all COs related to a course. The total attainment is the sum of 30% of internal attainment and 70% of university attainment.

- Internal Attainment is the average of attainments obtained using various internal assessment tools.
- Total Attainment = 30% internal attainment + 70% university attainment

CO-PO attainment of the Program (Sample)

| CO No. | Statement of COs | PO1 | Attain- ment | PO2 | Attain- ment | PO3 | Attain- ment | PO4 | Attain- ment | PO5 | Attain- ment |
|------------------|---|------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|
| CO-1 | Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier. | 2 | 3 | 1 | 1 | | | | | | |
| CO-2 | Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications. | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | | |
| CO-3 | Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies. | 1 | 1 | 3 | 3 | 1 | 1 | | | 1 | 1 |
| CO-4 | Explain internal schematic of Op-Amp and define its performance parameters. | 2 | 3 | | | | | | | | |
| CO-5 | Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications. | 2 | 2 | 2 | 2 | 1 | 1 | | | | |
| CO-6 | Understand and compare the principles of various data conversion techniques and PLL with their applications. | 2 | 2 | 1 | 1 | 1 | 1 | | | | |
| Mapping Criteria | | Avg Attainment of PO-1 | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| | | 2.53 | | 1.83 | | 1.50 | | 1.00 | | 1.00 | |



| Sr. No. | Class (Div) & Subject | CO No. | CO Attainment | PO1 | Attainment | PO2 | Attainment | PO3 | Attainment | PO4 | Attainment | PO5 | Attainment |
|---------|-----------------------|------------------------|---------------|------|------------|------------------------|------------|------------------------|------------|------------------------|------------|------------------------|------------|
| 1 | SE (A)-DS | CO-1 | 3.00 | 3.00 | 3.00 | | | 1.00 | 1.00 | | | | |
| | | CO-2 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | | | | | | |
| | | CO-3 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 1.00 | 1.00 | 2.00 | 2.00 | | |
| | | CO-4 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | 1.00 | 1.00 |
| | | CO-5 | 3.00 | 2.00 | 2.00 | | | | | | | | |
| | | CO-6 | 3.00 | 3.00 | 3.00 | | | 2.00 | 2.00 | 1.00 | 1.00 | | |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 2.83 | | | | 2.33 | | 1.50 | | 1.50 | | 1.00 | | | |
| 2 | SE (A)-EC | CO-1 | 2.80 | 3.00 | 3.00 | 1.00 | 1.00 | | | | | | |
| | | CO-2 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 3.00 | 3.00 | 1.00 | 1.00 | | |
| | | CO-3 | 3.00 | 1.00 | 1.00 | 3.00 | 3.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| | | CO-4 | 3.00 | 3.00 | 3.00 | | | | | | | | |
| | | CO-5 | 2.80 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | | | | |
| | | CO-6 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 2.33 | | | | 1.80 | | 1.50 | | 1.00 | | 1.00 | | | |
| 3 | SE (A)-Ecs | CO-1 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | | | 2.00 | 2.00 | | |
| | | CO-2 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| | | CO-3 | 2.80 | 3.00 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| | | CO-4 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| | | CO-5 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | | | | |
| | | CO-6 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | | |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 3.00 | | | | 2.50 | | 1.75 | | 2.00 | | 1.00 | | | |
| 1 | TE (A)-MECHA | CO-1 | 3.00 | | | | | 1.00 | 1.00 | 2.00 | 2.00 | | |
| | | CO-2 | 3.00 | | | | | 1.00 | 1.00 | 2.00 | 2.00 | | |
| | | CO-3 | 3.00 | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | |
| | | CO-4 | 3.00 | | | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | | |
| | | CO-5 | 3.00 | | | | | | | 2.00 | 2.00 | | |
| | | CO-6 | 3.00 | | | | | | | 2.00 | 2.00 | | |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 1.00 | | | | 1.00 | | 1.25 | | 1.60 | | 1.00 | | | |
| 2 | TE (A)-EM | CO-1 | 2.40 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 1.00 | 1.00 | 2.00 | 2.00 |
| | | CO-2 | 2.40 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | | |
| | | CO-3 | 1.92 | 3.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | | | | |
| | | CO-4 | 2.40 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | CO-5 | 2.40 | 3.00 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | CO-6 | 2.40 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 2.50 | | | | 2.33 | | 2.00 | | 1.00 | | 1.67 | | | |
| 3 | TE (A)-MC | CO-1 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | | |
| | | CO-2 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | | |
| | | CO-3 | 2.80 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| | | CO-4 | 2.84 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | 1.00 | 1.00 |
| | | CO-5 | 3.00 | 2.00 | 2.00 | 3.00 | 3.00 | 3.00 | 3.00 | | | | |
| | | CO-6 | 3.00 | 3.00 | 3.00 | | | 2.00 | 2.00 | 2.00 | 2.00 | | |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 2.67 | | | | 2.20 | | 2.00 | | 1.67 | | 1.00 | | | |
| 4 | TE (A)-DC | CO-1 | 2.40 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 1.00 | 1.00 | 2.00 | 2.00 |
| | | CO-2 | 2.40 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | | |
| | | CO-3 | 1.92 | 3.00 | 2.00 | 2.00 | 2.00 | | | | | | |
| | | CO-4 | 2.40 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | | | | |
| | | CO-5 | 2.40 | 3.00 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | CO-6 | 2.40 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 |
| | | Avg Attainment of PO-1 | | | | Avg Attainment of PO-2 | | Avg Attainment of PO-3 | | Avg Attainment of PO-4 | | Avg Attainment of PO-5 | |
| 2.50 | | | | 2.33 | | 2.00 | | 1.00 | | 1.67 | | | |



| Sr. No. | Class (Div) & Subject | CO No. | CO Attainment | PO1 | Attainment | PO2 | Attainment | PO3 | Attainment | PO4 | Attainment | PO5 | Attainment | |
|---------|-----------------------|--------|---------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|------|
| 1 | BE (A)-EPD | CO-1 | 3.00 | | | | | 2.00 | 2.00 | | | | | |
| | | CO-2 | 3.00 | | | | | | | | | 2.00 | 2.00 | |
| | | CO-3 | 3.00 | | | | | | | | | | | |
| | | CO-4 | 3.00 | | | | | 3.00 | 3.00 | | | 2.00 | 2.00 | |
| | | CO-5 | 3.00 | | | | | | | | | | | |
| | | CO-6 | 3.00 | | | | | | | | | 2.00 | 2.00 | |
| | | | | Avg. Attainment of PO-1 | | Avg. Attainment of PO-2 | | Avg. Attainment of PO-3 | | Avg. Attainment of PO-4 | | Avg. Attainment of PO-5 | | |
| | | | | 1.50 | | 1.33 | | 2.50 | | 1.50 | | 2.00 | | |
| 2 | BE (A)-CNS | CO-1 | 2.84 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | | | | | |
| | | CO-2 | 2.68 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | |
| | | CO-3 | 3.00 | | | | | | | | 1.00 | 1.00 | 2.00 | 2.00 |
| | | CO-4 | 3.00 | 1.00 | 1.00 | 2.00 | 2.00 | | | | | | | |
| | | CO-5 | 3.00 | | | | | 2.00 | 2.00 | 2.00 | 2.00 | | | |
| | | CO-6 | 3.00 | 2.00 | 2.00 | | | | | | | | | |
| | | | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | |
| | | | | 1.50 | | 1.33 | | 2.00 | | 1.50 | | 2.00 | | |
| 3 | BE (A)-RMT | CO-1 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | | | | | | | |
| | | CO-2 | 3.00 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | |
| | | CO-3 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| | | CO-4 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | | | |
| | | CO-5 | 3.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| | | CO-6 | 3.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | | | |
| | | | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | |
| | | | | 2.00 | | 1.50 | | 1.25 | | 1.50 | | 1.00 | | |
| 4 | BE (A)-VLSI | CO-1 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | | | |
| | | CO-2 | 2.84 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | | | |
| | | CO-3 | 2.68 | 3.00 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | |
| | | CO-4 | 2.52 | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | | | 1.00 | 1.00 | |
| | | CO-5 | 3.00 | 2.00 | 2.00 | 3.00 | 3.00 | 3.00 | 3.00 | | | | | |
| | | CO-6 | 3.00 | 3.00 | 3.00 | | | 2.00 | 2.00 | 2.00 | 2.00 | | | |
| | | | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | Avg. Attainment | | |
| | | | | 2.67 | | 2.20 | | 2.00 | | 1.67 | | 1.00 | | |

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