# Department Of Computer Science and Engineering

# CO, PO, PSO and PEO Assessment Manual

For

Bachelor of Technology in Computer Science and Engineering

Academic Year 2022-23

## United Institute Of Technology Prayagraj

(College Code: 284)

D-3, UPSIDC Industrial Area, Naini, Prayagraj

Approved by, All India Council for Technical Education, New Delhi

Affiliating University: Dr. A. P. J. Abdul Kalam Technical University Uttar Pradesh, Lucknow

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# 1. Introduction

The United Group, founded by Late Shri Shiv Ram Das Gulati in 1951 emerged from a transport business to the giants in the fields of education, health, services, transportation and journalism. The group made a mammoth leap in the education arena in mid 80s by being the pioneers in computer education.

United Institutes work on the motto of holistic education of its students. Hence every measure is taken that their progress does not remain constrained to the classrooms. Ample scope for extracurricular activities along with classroom syllabus keeps the student at par with the best of the institutes. The campuses are located away from the city, landscaped stunningly to create a peace of mind and make the environment academically inductive.

Special care is given to the courses of the student which demand industrial trainings and visit. The Naini industrial area provides the perfect opportunity for the students to gain hands on experience and getting to know the grooves of the industry.

At United we believe in taking the course of progress in the fields of technology and administration to the pinnacle. Therefore, our motto remains fostering the young minds of today, who will in turn create history tomorrow.

United Institute of Technology Allahabad was established in the year 2007 and offers undergraduate courses in Civil Engineering, Mechanical Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Computer Science & Engineering, and Information Technology. Postgraduate courses in Computer Science & Engineering, and Electronics and Communication Engineering are also offered by the institute. The Institute is approved by All India Council for Technical Education, New Delhi and affiliated to Dr. A. P. J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow and has been allotted Code 284.

# 2. Vision and Mission

## 2.1 Vision of United Group of Institutions

We at United Group of Institutions, aim at creating a workforce of professionals with analytical skills who can dream a better world and transform the dream into reality.

We aim to create a dynamic and collaborative climate to broaden our students' competence, and build an Institute that is resilient, flexible and productive and attain recognition for high ethical standards and responsiveness to the social environment.

## 2.2 Mission of United Group of Institutions

We aspire to reassert the significance of high quality education by producing competent professionals who can shape the destiny of our nation into a stronger and developed stature.

We envisage that high quality education using interactive methodologies will equip students to excel as a professional. The values instilled among students while imparting education, will strengthen the moral and ethical fabric of the nation and revive the human spirit. The zeal of competitiveness will always be positive and setbacks will only be catalysts for greater achievements

With these beliefs, the United Group will strive towards faster evolution, and will make its marks on the global academic map.

## 2.3 Vision of United Institute of Technology

To be a value-based institution continuously striving for excellence in engineering education, research and entrepreneurship development, fostering habitude of skill development and multidimensional growth.

## 2.4 Mission of United Institute of Technology

M1: To provide state-of-the-art infrastructure and conducive learning environment to analyze, investigate, design and develop solutions using engineering knowledge.

M2: To foster a habitude of skill development and entrepreneurship focused towards in-depth knowledge, leadership and multidimensional growth.

M3: To conduct impactful research, generate novel ideas and reach innovative solutions for addressing the needs of the society.

M4: To inculcate ethical values and social responsibility in thoughts, expressions and deeds, individually and also collectively.

## 2.5 Vision of Department Of Computer Science & Engineering

To be a centre of excellence in the field of Computer Science and Engineering for producing talented engineers to ethically serve constantly changing needs of society and industry throughout their career and life.

## 2.6 Mission of Department Of Computer Science & Engineering

M1: Accomplish excellence with committed faculty by providing theoretical foundation and practical skills for solving complex engineering problems in the state-of-the-art trends in Computer science and allied disciplines.

M2: To foster skills and competency, generating novel ideas, entrepreneurship and model creations focused towards deep knowledge, interpersonal skills and leadership.

M3: To develop habitude of research among faculty and students in the area of Computer Science & Allied disciplines by providing the desired environment, for addressing the needs of industry and society.

M4: To mould the students with ethical principles in thoughts, expression and deeds.

## 2.7 Process for Establishing / Updating the Vision and Mission Statements of the Department

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

Step 1: As per directions of the Central Planning Committee (CPC), the Department Planning Committee (DPC) starts the revision process for the Vision and Mission statements.

Step 2: The newly drafted Vision and Mission of the Institute are taken as the basis along with the current Vision and Mission statements of the Department.

Step 3: The Department conducts brain-storming sessions with the faculty members on the skill set required by the Employers, Industries, and R&D.

Step 4: The Department establishes the draft version of the Vision and Mission statements.

Step 5: The views from stakeholders are collected and incorporated to revise the drafted version of the Vision and Mission statements of the Department based on their inputs.

Step 6: The CPC reviews/approves the modified draft version received from DPC.

Step 7: If the CPC is not satisfied with the draft version of the Department's Vision and Mission statements, it is again sent for modification to the DPC, otherwise approval is sent to the DPC for further processing and publication.

Step 8: The Department will publish and disseminate the newly established Vision and Mission statements at identified places.

The process is shown in the flowchart in Figure 2.1.

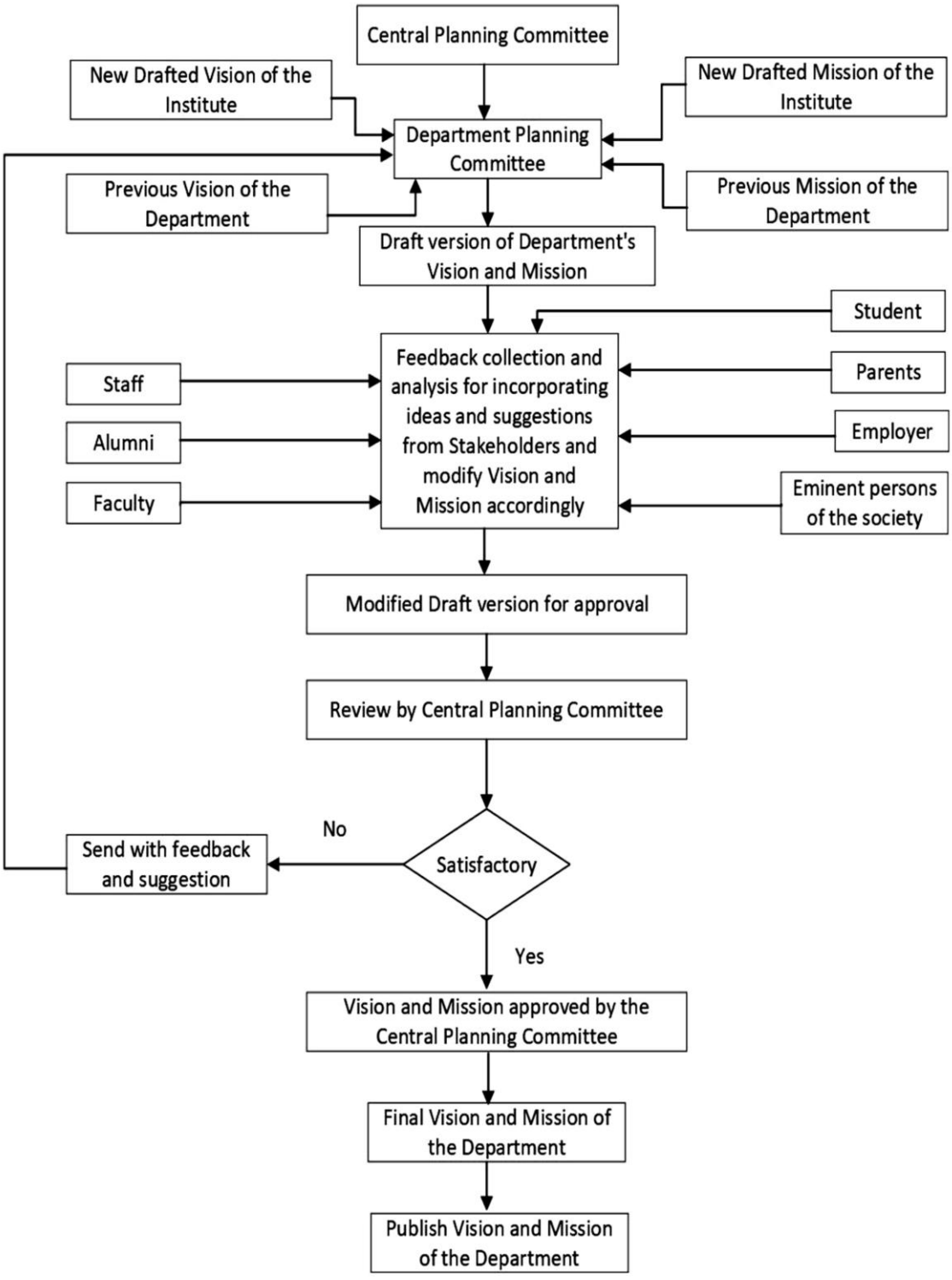



Figure 2.1: Process for Establishing / Updating the Vision & Mission Statements of the Department

# 3. Outcome-Based Education (OBE)

OBE is a model of education that rejects the traditional focus on what the school provides to students, in favor of making students demonstrate that they "know and are able to do" whatever the required outcomes are. OBE reforms emphasize setting clear standards for observable and measurable outcomes. This means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences.

The Outcome-based education (OBE) philosophy is "Success for all students and staff" by

- Ensuring that all students are equipped with the knowledge, competence, and qualities needed to be successful after they exit the educational system.
- Structuring and operating institutions so that those outcomes can be achieved and maximized for all students.

OBE has proven to be a success in helping institutions measure their learning outcomes and at the same time enabling students to develop new skills that prepare them to stand out with their global counterparts.

OBE ensures the following:

- Instead of passing the same curriculum to the next generation, the curriculum is planned and designed as per the needs of today's students.
- Instead of focusing on completing the syllabus by the end of the semester, the teachers have to be focused on developing new skills in the students.
- Instead of assessing students on their grade, they are assessed on the 'Levels' that track their learning skills

For implementing and achieving the OBEs following methodology has been followed:

1. Establishment of Mission statements
2. Establishment of Program Educational Objectives (PEOs)
3. Mapping of Mission statements and Program Educational Objectives (PEOs)

The mission statements have been chosen keeping the emerging trends in computing and these have been framed to help achieve the Program Educational Objectives (PEOs).

To arrive at the final statements, following surveys had been conducted to get into the nerves of the current industry, meet-up with the challenges, existing norms and learn the prevailing demands of the IT industry. Employers, students, alumni and parent / guardian have also been pooled into the list for building Outcome-Based Education (OBE) more effective. Every effort has been made to keep the Program Educational Objectives (PEOs) in line with the organizational business goals. Further, the mission statements alongside the PEOs have been communicated and explained to faculty, students and all levels of employees.

- Employer survey
- Student survey
- Alumni survey
- Parent / Guardian survey
- Eminent Persons survey

The Program Educational Objectives (PEOs), Program Outcomes (POs), Program Specific Outcomes and (PSOs) and Course Outcomes (COs) are defined, developed and validated though their attainment.

## 3.1 Program Educational Objectives (PEOs)

The PEOs have been prepared keeping in view the following:

i. The students should acquire such a disciplined knowledge in the field of computer science and allied fields to be able to compete in an effective way globally for employment and / or higher studies / up gradation of their skills.

ii. To provide an environment to develop professionalism and lifelong learning.

The PEOs are

PEO1. Excel in professional career and higher education by acquiring knowledge in mathematical computing and Computer Science & Engineering principles.

PEO2. Apply modern tool usage, contextual knowledge and computer science to provide novel engineering solutions and efficient product design to meet the future technological needs of the society and industry.

PEO3. Adopt professionalism, ethical attitudes, communication skills, team work and lifelong learning in their profession.

The above PEO statements have been established through the following process, which is similar to the process of establishment of Vision and Mission statements:

Step 1: As per directions of the Central Planning Committee (CPC), the Department Planning Committee (DPC) starts the revision process for the PEO statements.

Step 2: The newly drafted Vision and Mission statements of the Department are taken as the basis.

Step 3: The Department conducts brain-storming sessions with the faculty members on the skill set required by the Employers, Industries, and R&D.

Step 4: The Department establishes the draft version of the PEO statements.

Step 5: The views from stakeholders are collected and incorporated to revise the drafted version of the PEO statements of the Department based on their inputs.

Step 6: The CPC reviews/approves the modified draft version received from DPC.

Step 7: If the CPC is not satisfied with the draft version of the Department's PEO statements, it is again sent for modification to the DPC, otherwise approval is sent to the DPC for further processing and publication.

Step 8: The Department will publish and disseminate the newly established PEO statements at identified places.

## 3.2 Program Outcomes (POs):

Program Outcomes are statements about the knowledge, skills and attitudes / attributes / abilities the graduate of a formal engineering program should have upon graduation. These are the central organizing feature of student learning. Program Outcomes (PO) can only be achieved and demonstrated through the integration of course components and Course Outcomes (CO).

To effectively define the PO statements, these must be checked, whether they satisfy following characters:

- Must define the scope and depth of the program

- Should focus on the end-point of the program
- Identify what typically students will know and be able to do on graduation
- Should be measurable, realistic and achievable within the context and timeframe
- Must be realized through component courses over the extent of the program
- They should be demonstrated through course assessment, particularly in final year courses, and especially through capstones.

These are defined by Accreditation Agencies of the country i.e. NBA as given below:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and their engineering specialization to the solution of Complex Computer Science and engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyze Complex Computer Science and engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for Complex Computer Science and 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 for Complex Computer Science and engineering problems:

- That cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories and techniques
- That may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions
- Those require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, time, memory requirements, durability, product life, etc.
- Which need to be defined (modeled) within appropriate mathematical framework and.

- Those often require use of modern computational concepts and tools, for example, in the design of a software for a real time system.

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to Complex Computer Science and 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 these to 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 lifelong learning in the broadest context of technological change.

## Competencies & Performance Indicators for Program Outcomes

1. Program Outcome 1

1.1 Demonstrate competence in mathematical modeling

- Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems

- Apply the concepts of probability, statistics and queuing theory in modeling of computerbased system, data and network protocols.

1.2 Demonstrate competence in basic sciences

- Apply the knowledge of laws of natural science to obtain solution of engineering problems.

1.3 Demonstrate competence in engineering fundamentals

- Apply the knowledge of engineering fundamentals to obtain solution of engineering problems.

1.4 Demonstrate competence in specialized engineering knowledge to the program

- Apply theory and principles of computer science and engineering to solve an engineering problem

2. Program Outcome 2

2.1 Demonstrate an ability to identify and formulate complex engineering problem

- Evaluate problem statements and identify objectives
- Identify processes / modules / algorithms of a computer-based system and parameters to solve a problem
- Identity mathematical algorithmic knowledge that applies to a given problem

2.2 Demonstrate an ability to formulate plan and methodology for a solution of an engineering problem

- Reframe the computer-based system into interconnected subsystems
- Identity functionalities and computing resources
- Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
- Compare and contrast alternative solution/methods to select the best methods
- Compare and contrast alternative solution processes to select the best process

2.3 Demonstrate an ability to formulate and interpret a model

- Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
- Identity design constraints for required performance criteria

2.4 Demonstrate an ability to execute a solution process and analyze results

- Applies engineering mathematics to implement the solution
- Analyze and interpret the results using contemporary tools
- Identify the limitations of the solution and sources/causes  Arrive at conclusions with respect to the objectives.

3. Program Outcome 3

3.1 Demonstrate an ability to define a complex/open-ended problem in engineering terms

- Able to define a precise problem statement with objectives and scope
- Able to review state-of-the-art literature to synthesize system requirements.
- Able to choose appropriate quality attributes as defined by ISQ/IEC/IEEE standard
- Explore and synthesize system requirements from larger social and professional concerns
- Able to develop software requirement specifications (SRS).

3.2 Demonstrate an ability to generate a diverse set of alternative design solutions

- Able to explore design alternatives
- Able to produce a variety ol potential design solutions suited to meet functional requirements.
- Identify suitable non-functional requirements for evaluation of alternate design solutions

3.3 Demonstrate an ability to select optimal design scheme for further development

- Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
- Consult with domain experts and stakeholders to select candidate engineering design solution for further development

3.4 Demonstrate an ability to advance an engineering design to defined end state

- Able to reline architecture design into a detailed design within the existing constraints
- Able to implement and integrate the modules
- Able to verify the functionalities and validate the design

4. Program Outcome 4

4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding

- Define a problem for purposes of investigation, its scope and importance
- Able to choose appropriate procedure algorithm, dataset and test cases
- Able to choose appropriate hardware/software tools to conduct the experiment.

4.2 Demonstrate an ability to design experiments to solve open-ended problems

- Design and develop appropriate procedures/methodologies based on the study objectives

4.3 Demonstrate an ability to analyze data and reach a valid conclusion

- Use appropriate procedures, tools and techniques to collect and analyze data
- Critically analyze data for trends and correlations, stating possible errors and limitations
- Represent data (tabular / graphics format) to analyze & explain the data and draw conclusions.
- Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

5. Program Outcome 5

5.1 Demonstrate an ability to identify/create modern engineering tools, techniques and sources

- Identify modern engineering tools, techniques and resources for engineering activities
- Create/ad and tools and techniques to solve engineering problems

5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques and resources

- Identify the strengths and limitations of tools for
  - (i) Acquiring Information
  - (ii) Modeling and simulating,
  - (iii) Monitoring system performance, and
  - (iv) Creating software / hardware architecture and design.
- Demonstrate proficiency in using CS/IT tools

5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem

- Discuss limitations and validate tools, techniques and resources
- Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

6. Program Outcome 6

6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare

- Identity and describe various engineering roles: particularly as pertains to protection of the public and public interest at the global, regional and local level

6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards

- Interpret legislation, regulations, codes, and standards relevant to your discipline and explain is contribution to the protection of the public

7. Program Outcome 7

7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts

- Identity risks/impacts in the life-cycle of an engineering product or activity
- Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability

7.2 Demonstrate an ability to apply principles of sustainable design and development

- Describe management techniques for sustainable development
- Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

8. Program Outcome 8

8.1 Demonstrate an ability to recognize ethical dilemmas

- Identity situations of unethical professional conduct and propose ethical alternatives

8.2 Demonstrate an ability to apply the Code of Ethics

- Identify tenets of the ASME professional code of ethics

- Examine and apply moral & ethical principles to known case studies

9. Program Outcome 9

9.1 Demonstrate an ability to form a team and define a role for each member

- Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
- Implement the norms of practice (eg, rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal

9.2 Demonstrate effective individual and team operations-- communication, problem-solving, conflict resolution and leadership skills

- Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
- Treat other team members respectfully
- Listen to other members
- Maintain composure in difficult situations

9.3 Demonstrate success in a team-based project

- Present results as a team with smooth integration of contributions from all individual efforts

10. Program Outcome 10

10.1 Demonstrate an ability to comprehend technical literature and document project work

- Read, understand and interpret technical and non-technical information
- Produce clear well-constructed and well-supported written engineering documents
- Create flow in a document or presentation - a logical progression of ideas so that the main point is clear

10.2 Demonstrate competence in listening, speaking, and presentation

- Listen to and comprehend information, instructions, and viewpoints of others
- Deliver effective oral presentations to technical and non-technical audiences

10.3 Demonstrate the ability to integrate different modes of communication

- Create engineering standard figures, reports and drawings to complement writing and

- presentations

Use a variety of media effectively to convey a message in a document or a presentation

11. Program Outcome 11

11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity

- Describe various economic and financial costs/benefits of an engineering activity
- Analyze different forms of financial statements to evaluate the financial status of an engineering project

11.2 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity

- Analyze and select the most appropriate proposal based on economic and financial considerations

11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints

- Identity the tasks required to complete an engineering activity and the resources required to complete the tasks
- Use project management tools to schedule an engineering project, so it is completed on time and on budget.

12. Program Outcome 12

12.1 Demonstrate an ability to identity gaps in knowledge and a strategy to close these gaps

- Describe the rationale for the requirement for continuing professional development
- Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice

- Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current

- Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

12.3 Demonstrate an ability to identify and access sources for new information

Source and comprehend technical literature and other credible sources of information

- Analyze sourced technical and popular information for feasibility, viability, sustainability, etc

The above mentioned twelve Program Outcomes (POs) can be divided into following two categories:

Category 1: Learning, acquiring and using Technical Skills

Category 2: Using and transferring skills to environment

The action verbs used in these POs and can also be identified and correlated with course outcomes Bloom's levels. These observations are given in table below:

Table 3.1: verbs used in these POs and correlated with course outcomes Bloom's levels

| 'Program Outcomes | Category | Action Verbs Used | Corresponding Bloom's Level of POs | COs Bloom's Level |
|---|---|---|---|---|
| Engineering Knowledge (PO1) | Learning,acquiringandusingTechnical Skills | Apply | K3 | (i) Theory courses K1 to K4<br>(ii) Practical Courses K1 to K5<br>(iii) Project / Mini Project K1 to K6 |
| Problem Analysis (PO2) | | Identify | K 2 | |
| | | Formulate | K 6 | |
| | | Review | K 2 | |
| Design / Development of Solutions (PO3) | | Design | K 3, K 6 | |
| | | Develop | K 3, K 6 | |
| Conduct Investigations of Complex Problems (PO4) | | Analyze | K 4 | |
| | | Interpret | K 2, K 3 | |
| | | Design | K 6 | |
| Modern Tool Usage (PO5) | | Create | K 6 | |
| | | Select | K1, K 2. K6 | |
| | | Apply | K 3 | |
| The Engineer & Society (PO6) | | Apply | K 3 | |
| | | Assess | K 3 | |
| Environment & Sustainability (PO7) | | Rules:<br>1. If K1 action verb of a CO correlates with any of PO7 to PO12 then correlation is one (1) | | |
| Ethics (PO8) | | | | |

| | | |
|---|---|---|
| Individual and Team Work (PO9)<br>Communication (PO10)<br>Project Management and Finance (PO11)<br>Life Long Learning PO12) | Usingandtransferringskills toenvironment | 2. If K2 to K3 action verbs of a CO correlates with any of PO7 to PO12 then correlation is two (2)<br>3. If K4 to K6 action verbs of a CO correlates with any of PO7 to PO12 then correlation is three (3) |

## 3.3 Program Specific Outcomes (PSOs): These outcomes are specific to a program in addition to the POs already defined above. These may be 2 to 4 in numbers.

- PSO1: Ability to use mathematical abstraction, algorithm design and appropriate data structures to solve real world problems using different programming paradigms.
- PSO2: Ability to develop computing solutions for problems in multidisciplinary areas by applying software engineering principles.
- PSO3: Gain knowledge in diverse areas of computer science and management skills for successful career, entrepreneurship and higher studies.

## 3.4 Bloom's Taxonomy

Bloom's Taxonomy is a multi-tiered hierarchical model of classifying thinking according to six cognitive levels of complexity. The taxonomy is hierarchal in the sense that each level is subsumed by the higher levels. For example, a student working at "Application Level" is supposed to have also mastered the materials at "Knowledge" and "Comprehension" levels.

During 1990s Lorin Anderson revised the Bloom's Taxonomy, hoping to add relevance to 21st century students and teachers as shown below:

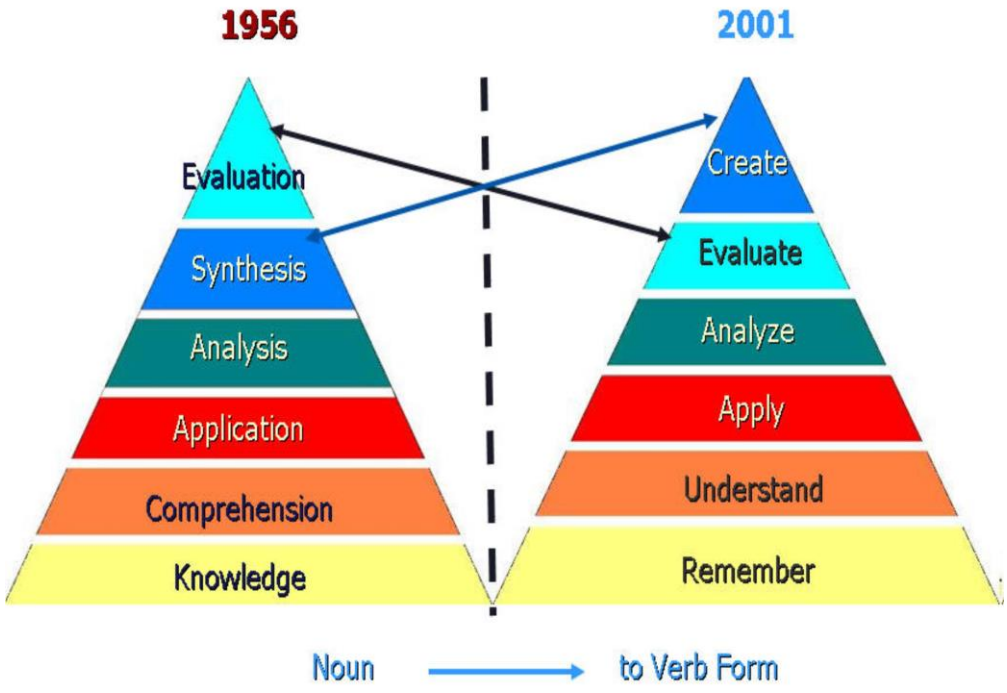



Figure 3.1: Bloom's Taxonomy (Revised)

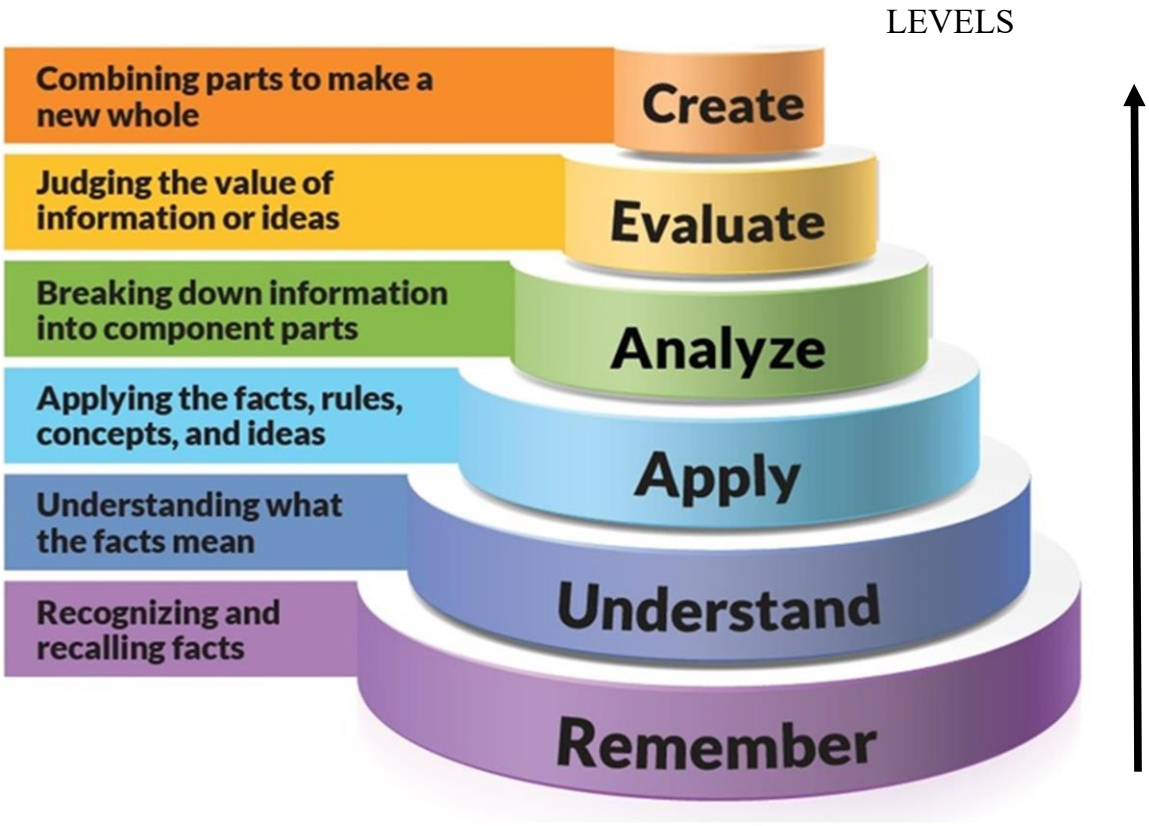



Figure 3.2 Bloom's Taxonomy levels

| Definitions | Bloom's Definition | Action Verbs |
|---|---|---|
| Remembering( K1) | Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers. | Choose, Define, Find, How, Label, List, Match, Name, Omit, Recall, Relate, Select, Show, Spell, Tell, What, When, Where, Which, Who, Why |
| Understanding | Demonstrate understanding of facts and ideas by organizing, comparing, | Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, |

| | | |
|---|---|---|
| (K2) | translating, interpreting, giving descriptions, and stating main ideas. | Outline, Relate, Rephrase, Show, Summarize, Translate |
| Applying (K3) | Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way. | Apply, Build, Choose, Construct, Develop, Experiment, with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize |
| Analyzing(K4) | Examine and break information into parts by Identifying motives or causes. Make inferences and find evidence to support generalizations. | Analyze, Assume, Categorize Classify, Compare, Conclusion, Contrast, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, List, Motive, Relationships, Simplify, Survey, Take part in, Test for, , Theme |
| Evaluating (K5) | Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. | Agree, Appraise, Assess, Award, Choose, Compare, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Explain, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value |
| Creating (K6) | Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions. | Adapt, Build, Change, Choose, 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, Solution, Solve, Suppose, Test, Theory |

Table 3.2: Bloom's Taxonomy Definitions and Action verbs

The definitions and verbs for Bloom's Taxonomy are given in the table below. Care must be taken to ensure that the verbs chosen for lesson level objectives build up to the level of the verb that is in the course level objective. The lesson level verbs can be below or equal to the course level verb, but they CANNOT be higher in level.

## 3.5 Rubric

A rubric is a scoring guide, for both teacher and student, for evaluating the performance of students in their quiz, test, laboratory work, examination, or a project. It has following three parts:

I. Performance criteria

II. Rating scale and

III. Indicators.

Rubric defines what is expected and what will be assessed according to specified criteria, making grading and ranking simpler, more transparent, and fairer.

A rubric looks like as shown below:

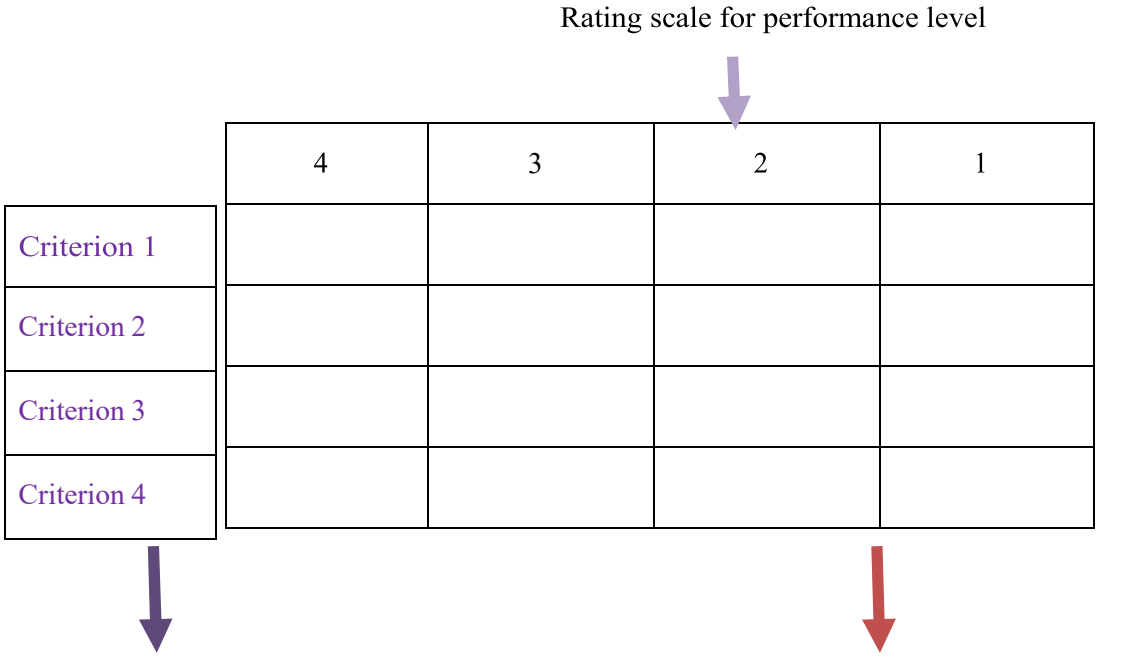



Figure 3.3: Rubric Structure

## 3.6 Criteria to Assess Student Work

Ideally, a rubric will have three to five performance criteria depending upon areas that really matter to the quality of the work that's being produced and what are expectations from the students for example:

What students need to demonstrate in the assignment?

- What are the learning outcomes of this unit?
- Which learning outcomes will be listed in the rubric?
- Which skills are essential at competent or proficiency levels for the task or assignment to be complete?
- How important is the overall completion of the task or project?

## 3.7 Course Outcomes (CO):

Course Outcomes are the statements of knowledge / skills/ abilities that students are expected to know, understand and perform as a result from their learning experiences in each course. A welldefined CO facilitates faculty in designing suitable delivery and assessment methods to achieve the designed CO in the beginning of a semester and in measuring the achievement of the CO at the end of the semester. The course outcomes should be SMART.

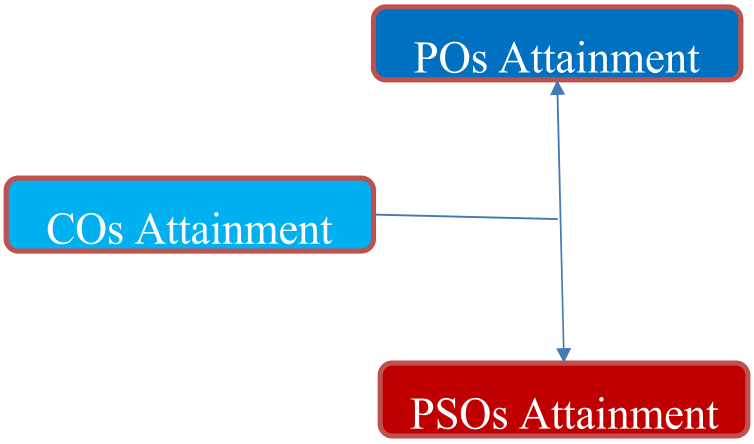
Table 3.3: course outcomes should be SMART

| | |
|---|---|
| Specific | They must provide description of precise behaviour and situation it will be performed. And must be concrete, focused and detailed |
| Measurable | The performance of the objective must be observed and measured |
| Achievable | The objective must be achieved by using reasonable amount of effort |
| Realistic | They must be appropriate for the student and the situation |
| Time-bound | Must be clearly stated with a time limit for accomplishing objective |

The course outcomes have already been described by the University along with each course based on the Bloom's Taxonomy, which has been described below:

Table 3.4: TEACHING - LEARNING STRATEGIES ADOPTED

| | |
|---|---|
| 1. BLENDED LEARNING with Flipped Class<br>2. Lecture<br>☐ Computer Aided Presentation<br>☐ Direct Instruction<br>☐ Fully Online Instruction<br>☐ Case Study<br>3. Computer Labs/Laptop Instruction<br>☐ Demonstration<br>☐ Drill And Practice<br>4. Project Development<br>☐ Project Presentation<br>☐ Question And Answer | 4. Group Activities<br>5. DISCUSSION & Brain Storming<br>6. Self-Learning<br>• Assignments<br>• MOOC<br>• Tutorial<br>• Seminar<br>• Web-Enhanced Learning<br>7. Mental Modeling<br>8. Examination |




## Assessment and Attainment

Assessment Methods weightage and Frequency

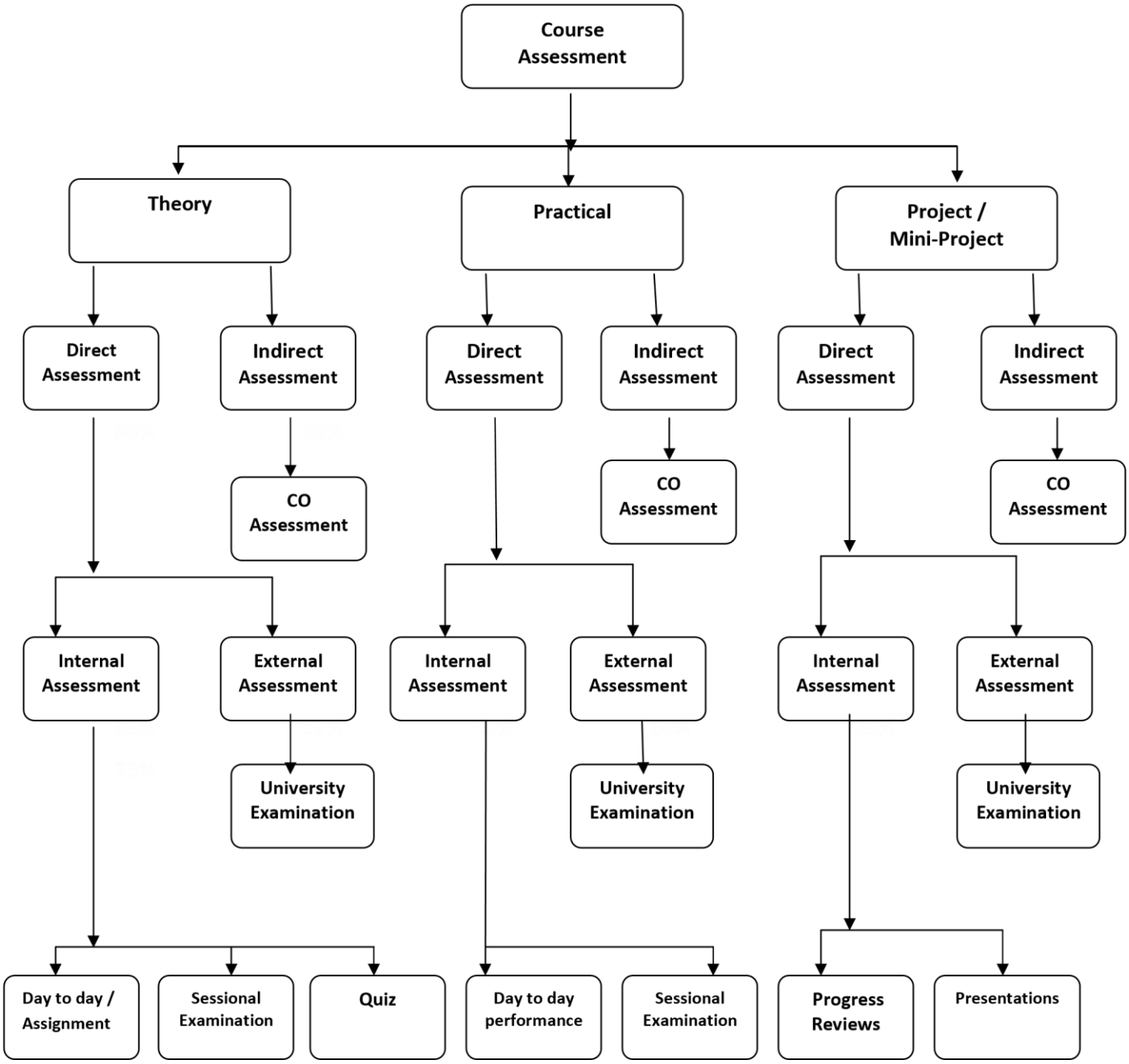



Figure 3.4: Flowchart for Course Assessment

## 3.8 Course Outcome Assessment

Each course is evaluated by two type of tools / methods i.e. direct assessment tools and indirect assessment tools.. Direct assessment tools / methods are to assess the students' knowledge and performance, which they have gained in the class and other activities such as assignment,

workshops, seminars, lectures by eminent persons etc. Direct assessment is carried out by Internal and external assessments and indirect assessment is carried out by a course exit survey and if required by feedbacks from examiners and employers. Schedule of direct assessments is prepared by the course coordinator while meeting the requirements of the Affiliating University AKTU regulations.

The list of CO assessment tools, frequency and weightage are shown in the figure and table below.

Table 3.5: List of CO Assessment Tools, Frequency and weightage

| Assessment Tools/Methods | Direct | Internal | Tools / Methods | Frequency | Weightage |
|---|---|---|---|---|---|
| | | | Day to day | Regular | |
| | | | Mid SEM Exam | Twice / SEM | 30 |
| | | | Quiz | For all COs | 10 |
| | | | Assignment | For all COs | 20 |
| | | | Practical | Regular | 25 |
| | | | Mini -Project | Once | 50 |
| | | | Project | Regular | 100 |
| | | External | End Semester Examination (Theory) | Once in a semester | 150 |
| | | | End Semester Examination (Practical) | Once in a semester | 25 |
| | | | End Semester Examination (Project) | Once in a semester | 300 |
| | | | Program Exit Survey | Once per year | |

| | | | | |
|---|---|---|---|---|
| | Indirect | Alumni Feedback | Once per year | |
| | | Parent Feedback | Once per year | |

1. Assessment of theory courses:

- Direct Assessment: Direct assessment of theory courses is carried out by Internal and External assessment of each defined CO
  - Internal Assessment:

(a) Day to Day assessments: It is carried out for enhancing the learning process of the students on regular basis. At least one class test and any other direct assessment tools e.g. assignments, Quiz, Surprise test etc as desired by the course coordinator is / are conducted.

(b) MID Semester (Sessional) Examinations: Two descriptive examinations are conducted as per the Affiliating University AKTU schedule by the course coordinator for one and half an hour with no choice, covering all the COs of the course as detailed below:

i. Two Sessional Tests with equal weightage of marks are conducted according to academic plan of the institute and covers all possible levels of Blooms Taxonomy. It is taken care that each test covers 50% COs respectively. In case of odd numbered COs in any subject one of the COs may appear in both sessional tests with different levels of Bloom's Taxonomy.

ii. One Make-up Test is also conducted only for those students who fail to appear in either any one or both sessional tests due to some or other reason. No student is allowed to appear in make-up test for improving their performance i.e. those students who have been appeared in both sessional tests.

iii. Final sessional marks are calculated by taking average of both sessional test marks OR only makeup test.

(c) Quiz: MCQ / Objective examination is conducted, covering all COs, as many times as per the choice of course coordinator.

(d) Assignments: The assignments are important to analyze ideas and concepts learned and to consider the relationships among them. Regular home assignments are given for improving self learning / web enhanced learning for following:

- Cognitive enhancement
- Ensured knowledge gain
- Improved writing pattern
- Augmenting reasoning and analytical skills
- Augmenting Planning & organization tactics and skills
- Increased focus on studies
- Improved time management skills

It is ensured that the entire COs and all possible levels of Blooms Taxonomy are covered. Assignment marks are calculated by averaging marks of all assignments.

- External Assessment:
- At the end of every semester, a three hours examination is conducted by the Affiliating University AKTU.

- Indirect Assessment:
  - At the end of the semester, after all examinations are over a survey on course learning outcomes with the students is conducted.

2. Assessment of Practical Courses:

- Internal Assessment:
- Day to Day assessments: It is carried out for getting the practical application / proof of the theories learnt. The assessment is carried out based on the results of experimentation results, lab reports and vivo voce conducted during / after the completion, of experimentation.

- Internal (Sessional) Examinations: After completion of all the scheduled experiments in the course, an internal examination for two / three hours is conducted by the course coordinator to assess the skills acquired by the student through theory classes and the practical sessions held.
- External Assessment:
- At the end of every semester, a three hours examination is conducted at the institute in presence of an External Examiner appointed by the Affiliating University AKTU.

 Indirect Assessment:

 At the end of the semester, after all examinations are over a survey on course learning outcomes with the students is conducted.

3. Mini Project Work / Industrial Training / Summer Training

Internal assessment only is conducted by examining implementation details & project report and viva voce examination during presentation.

4. Project Work

Project works are for collaborative learning, improvement of innovative & intellectual capabilities and also self learning.

Allotment: Projects to the students are allotted by a committee appointed by the department, after review of the synopsis submitted by either student or a faculty.

 Internal Assessment:

o Internal (Sessional) Examinations: It is carried out through regular reviews by a departmental committee in the following manner:

a. After the finalization of the project allotment, students are instructed to make a PowerPoint presentation on the project giving an overview of the model development and work progress so far.

b. Students are instructed to submit Design / Experimental document of the project and give a PowerPoint presentation on work progress so far.

c. Students are instructed to submit complete project report and PowerPoint presentation for the project.

- External Assessment:
- At the end of every semester, the assessment of project work is conducted through presentation of project work done and Vivo-voce, by a committee appointed by the department and an External Examiner appointed by the Affiliating University at the institute.

- Indirect Assessment:
  - At the end of the semester, after all examinations are over a survey on course learning outcomes with the students is conducted.

Course Outcomes are the statements of knowledge / skills/ abilities that students are expected to know, understand and perform as a result from their learning experiences in each course. The assessment processes described above gathers the required data which is used for evaluation of the attainments of Course Outcomes. The relevancy and appropriateness of the tools used for assessment is described in the Tables below.

Table 3.6: Relevancy and Appropriateness of Assessment method

| Types of Course | Assessment Type | Assessment Method | Appropriateness/Relevancy in Assessment |
|---|---|---|---|
| Theory | Internal | Sessional Test | Assessment of progress in a course and helping them to prepare for end semester examination |
| | | Assignment | To improve Self Learning skills |
| | | Quiz | Quick and informal assessment of student knowledge, concentration and confidence |
| | External | University Examination | For students to test their knowledge, rectify their skills, analyze new problems based on their whole semester study, and ultimately to qualify for the next semester. |
| Practical | Internal | Lab Experiments | Hands-on-learning continuous assessment |
| | | Practical Records | Solution representation assessment |
| | | Practical assessment | Semester - end department-level learning assessment |
| | External | University Examination | Semester-end university-level learning assessment |
| Summer | Internal | Presentation | Self-learning, Communication ability and life- |
| training / Mini project | | | long learning assessment |

| | | | |
|---|---|---|---|
| Seminar | Internal | | Students ability to improve their knowledge and understanding of a topic by engaging with key issues - |
| Project | Internal & External | | Apply their theoretical knowledge acquired to practical situations, explore new ideas, and develop problem-solving and critical thinking skills |

The various assessment tools, assessment frequency, assessing & reviewing authority and mapping of tools with COs for different type of courses are listed in the table.

Table 3.7: Assessment Process for Theory Courses

| Assessment Tool | Assessment Frequency | Assessing Authority | Reviewing Authority | Mapping with COs |
|---|---|---|---|---|
| Sessional Test-1 | ONE PER SEMESTER | Course Instructor | Department Advisory Committee | Relevant COs |
| Sessional Test-2 | | | | Remaining COs |
| Makeup Test | | | | All COS |
| Quiz 1 to n Where n is number of COs | | | | CO1 to n Where n is number of COs |
| Assignment 1 to n Where n is number of COs | | | | CO1 to n Where n is number of COs |
| Semester Exam | | Affiliating University | Affiliating University | All COs |

Table 3.8: Assessment Process for Practical Courses

| Assessment Tool | Assessment Frequency | Assessing Authority | Reviewing Authority | Mapping with COs |
|---|---|---|---|---|
| Lab Experiments | Regular throughout Semester | Course Instructor | Department Advisory Committee | All COS |
| Viva Voice | | | | All COS |
| Practical Record | | | | All COS |
| Internal Semester Exam | One Per Semester | Course Instructor | Department Advisory Committee | All COS |
| Semester Exam | One Per Semester | Affiliating University | Affiliating University | All COS |

Table 3.9: Assessment Process for Project

| Assessment Tool | Assessment Criteria | Assessment Period | Assessing Authority | Reviewing Authority | Mapping with COs |
|---|---|---|---|---|---|
| Progress Presentation-1 | Presentation Skill Implementation Details Documentation, Viva Voce | 7th Semester | Project Review Committee | Department Advisory Committee | All COS |
| Progress Presentation -2 | | 8th Semester | | | All COS |
| Internal Examination | | 8th Semester | | | All COS |
| External Examination | Presentation Skill Implementation Details Documentation, Viva Voce | 8th Semester | Affiliating University | Affiliating University | All COS |

Table 3.10: Assessment Process for Mini Project / Industrial Training

| Assessment Tool | Assessment Criteria | Assessment Period | Assessing Authority | Reviewing Authority | Mapping with COs |
|---|---|---|---|---|---|
| Progress Presentation | Presentation Skill<br>Implementation Details<br>Documentation, Viva Voce | One Per Semester | Seminar Review Committee | Department Advisory Committee | All COS |

Table 3.11: Assessment Process for MOOC

| Assessment Tool | Assessment Period | Assessing Authority | Reviewing Authority | Mapping with COs |
|---|---|---|---|---|
| ONLINE Assignments | Throughout Semester | IIT, Kanpur | IIT, Kanpur | All COS |
| Examination | Semester End | A K Technical University | A K Technical University | All COS |

For representing the correlation among COs, POs, PSOs and PEOs rating scale of 1 to 3 has been decide by the Departmental Planning Committee, where 1 is low, 2 is medium and 3 is high. If there is no correlation it is represented by "blank"

For describing the attainment levels also rating scale of 1 to 3 has been decide by the Departmental Planning Committee where 1 is low, 2 is medium and 3 is high. If there is no correlation it is represented by "blank"

Before starting the process of calculating the CO attainment levels, student number threshold levels and marks obtained threshold levels for each assessment tools are decided by the Departmental Planning Committee.

Such rubric is decided for internal and external assessments separately and for all assessment tools. Departmental Planning Committee decides the following and distributes it to every faculty member for calculation and records.

$ITST_i$: Internal Theory Student Number Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $ITST_1 < ITST_2 < ITST_3$

$ETST_i$: External Theory Student Number Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $ETST_1 < ETST_2 < ETST_3$

$PST_i$: Practical Student Number Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $PST_1 < PST_2 < PST_3$

$ITCT_i$: Internal Theory Course Score Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $ITCT_1 = ITCT_2 = ITCT_3$

ETCTi: External Theory Course Score Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $ETCT_1 = ETCT_2 = ETCT_3$

$PST_i$ : Practical Course Score Threshold, where i is 1, 2, 3 for attainment levels 1, 2, and 3 respectively and $PST_1 = PST_2 = PST_3$

Similarly for other tools the rubrics are decided..

All these threshold values are decided by taking the average of performance of last three years or as decided by Departmental Planning Committee. For example

For attainment level 3 of a CO if 70% or above students score more that 70% of marks

For attainment level 2 of a CO if 60% or above students score more that 70% of marks

For attainment level 1 of a CO if 40% or above students score more that 70% of marks

## 3.9 Setting of the Target level for all the Tools / Methods

Department advisory committee also sets the target level of attainment for the next year based on the performance of students in previous years.

## 3.10 Course Outcome Attainment Process

The Departmental Planning Committee after deciding the necessary threshold values etc. conveys it to all faculty members and also informs them to submit the attainment values as per schedule.

## 3.11 Process to find out the course outcome attainment of theory and practical subjects

Step 1: An Excel sheet will prepare for each assessment method of theory subject containing CO level score in each of the assessment method i.e. sessional test, quiz and assignment.

Step 2: In each frequency of the assessment method CO attainment level get calculated as per following rubric table.

Table 3.12: Rule for Internal Assessment ( For Theory Subjects)

| Rule for Internal Assessment ( For Theory Subjects) | Level |
|---|---|
| ITST1 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| ITST2 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| ITST3 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 3 (HIGH) |

Table 3.13: Rule for External Assessment ( For Theory Subjects)

| Rule for External Assessment ( For Theory Subjects) | Level |
|---|---|
| ETST1 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| ETST2 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| ETST3 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 3 (HIGH) |

Table 3.14: Rule ( For Practical's Subjects)

| Rule ( For Practical's Subjects) | Level |
|---|---|
| PST1 Percentage of students above the PCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| PST2 Percentage of students above the PCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| PST3 Percentage of students above the PCT Percentage of threshold level proposed by the HOD. | 3 (HIGH) |

Where:

ITST 1,2,3: Internal Theory Student Threshold (ITST1<ITST2<ITST3)

ITCT: Internal Theory Course Threshold

ETST 1,2,3: External Theory Student Threshold (ETST1<ETST2<ETST3)

ETCT: External Theory Course Threshold

PST 1,2,3 : Practical Student Threshold (PST1<PST2<PST3)

PCT: Practical Course Threshold

Step 3: Since AKTU University does not provide the score on CO basis thus overall score will be used to find the co attainment level equally applicable for all CO's as per the rubric defined above.

Step 4: Attainment of $CO_i$= (Summation of $CO_i$ attainment level as per in step 2 for each frequency of all assessment method)

(Total no. of time attainment mentioned for $CO_i$ )

$CO_i$ is the $i^{th}$ Course Outcome

Step 5: Overall internal attainment of CO = Average of all internal CO attainment level.

Step 6: Final CO attainment level = Weightage1 * overall internal attainment level + Weightage2* University exam CO attainment level.

Where

Weightage1 is Internal marks Weightage in total marks of Theory, Practical, Project etc.

Weightage2 is External marks Weightage in total marks of Theory, Practical, Project etc.

## 3.12 Process to a set attainment level

Step 1: A review committee comprising of CPC and DPC of respective department's for which attainment level is going to be decided will identify/ review PPO and SPO; and ensure PPO must attain the level already decided; though every effort made for SPO to attain the decided level for APY.

Step 2: Calculate attainment level for each PO using attainment calculation methodology from data collected through various evaluation tools.

Step 3: Step 2 will provide attainment level of APY to the CPC and DPC.

Step 4: If APY crosses attainment level of 2.5 for all decided PPO then CPC will decide the IPT value and calculate TCY using following equation:

$$TCY_i=TPY_i+IPT$$

And attainment level is set to two third of target level.

Else If APY crosses the attainment level for all decided PPO then CPC will decide the PIA and calculate the attainment level of current academic session using equation

$$ACY=APY(1+(PIA/100))$$

Else ACY and TCY will continue the value of APY and TPY respectively.

Step 5: CPC will provide the ACY and TPY value to the respective department's head for quality control of all teaching learning environment and process.

Where

PPO= Primary program outcome (Program outcomes which are necessary to be attained as decided by the CPC)

SPO= Secondary program outcome (Program outcomes which are not included in PPO)

ACY= Attainment level of current academic year

APY=Attainment level of Previous academic year

PIA= Percentage level increase in attainment level

TCY= Threshold level of current academic year rubrics

TPY= Threshold level of previous academic year rubrics

IPT= Point increase in the rubrics threshold value

## 3.13 Attainment of Program Outcomes and Program Specific Outcomes

All the theory and practical courses are directly related/mapped with PO's and PSO's. Achieving Course attainment is the direct way of accomplishing PO's and PSO's. Performance in various courses reflects the extent of achievement of PO's and PSO's. The detailed process is given below. The various direct and indirect tools and its frequency, the responsible authority to collect data for assessing the attainment of each PO, and PSO.

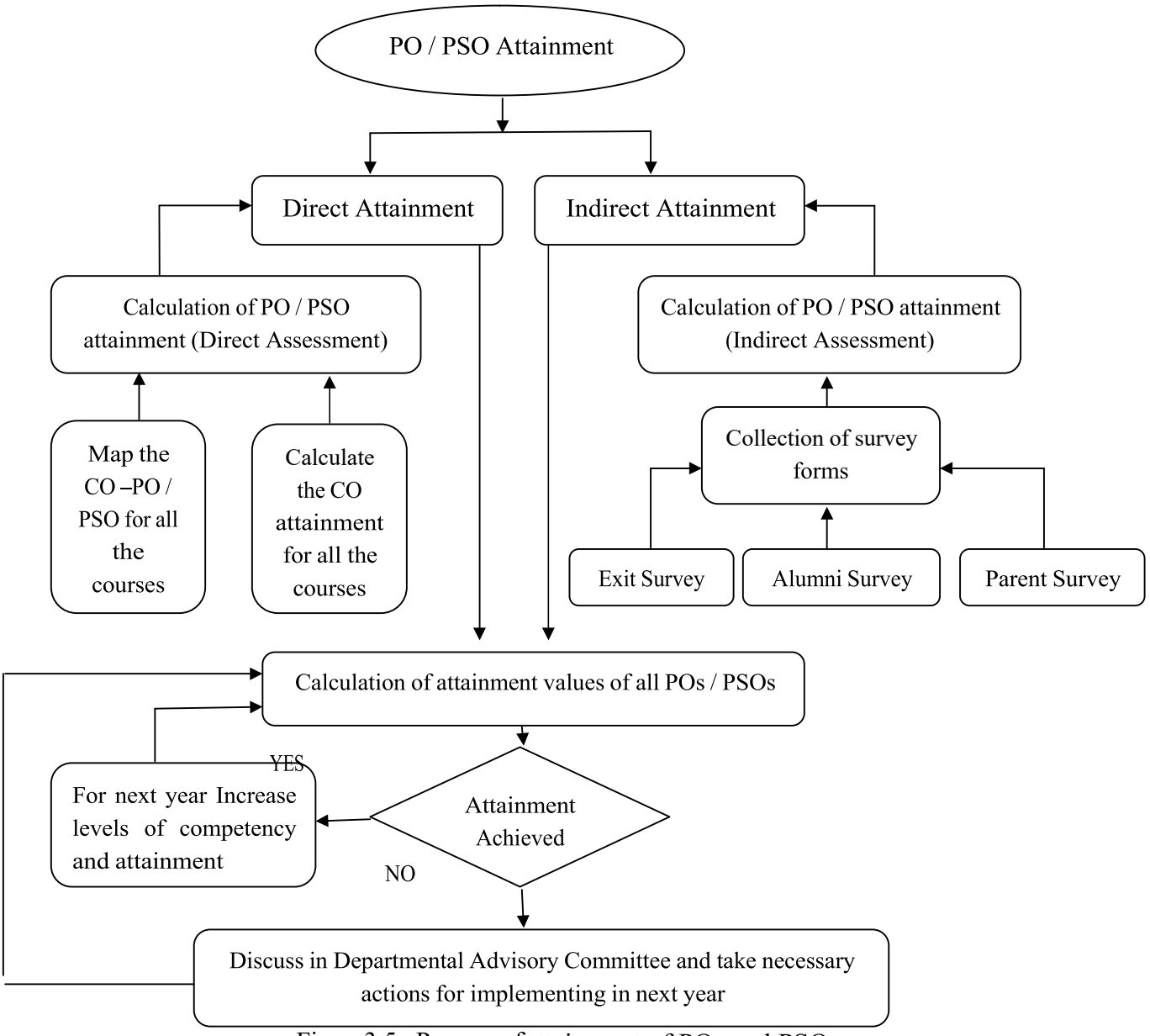



Figure3.5 : Process of attainment of POs and PSOs

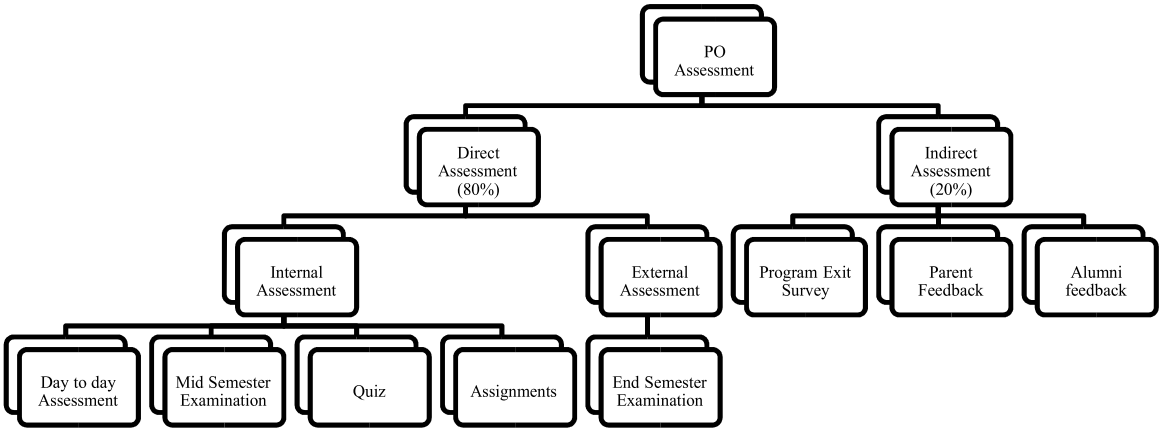



Figure 3.6: Composition of PO Attainment

Table 3.15: Direct Assessment Tools

| Type | Tools / Methods | Process |
|---|---|---|
| Internal | Theory<br>i. Sessional Tests<br>ii. Assignment iii. Quiz | i. Two Sessional examinations are conducted covering all COs<br>ii. Assignments are give covering all COs of the subject and for all possible Bloom's levels<br>iii. MCQ / Objective examination is conducted minimum one / unit of the course. |
| | Practical<br>i. Performance during experimentation<br>ii. Practical records iii. Sessional Tests | After completion of all the experiments in a course one sessional examination is conducted besides regular evaluation during each lab class. |
| | Project<br>i. Review Presentation ii. Implementation and Viva voce iii. Documentation | Regular reviews are held for evaluation of the progress of project work, its documentation. Implementation through presentation and viva voce by a departmental committee. |
| Externa | University Examination<br>i. Theory<br>ii. Practical iii. Project | At the end of a semester, the affiliating University conducts theory examination, practical examination with an external examiner and also for project work done with an external examiner. |

Table 3.16: Indirect Assessment Tools

| Type | Tools / Methods | Process |
|---|---|---|
| Internal | Surveys Online / Offline) i. Program Exit ii. Alumni Feedback iii. Parent Feedback | Feedback Survey is conducted to assess program level outcome from final year student, program level outcome at work and life-long learning from alumni and program outcome satisfaction of the parent. |

Table 3.17: Appropriateness/Relevancy in Direct Assessment

| Type of course | Assessment | Direct Assessment Method | Appropriateness/Relevancy in Assessment |
|---|---|---|---|
| Theory | Internal | Sessional Test | Institution-level continuous assessment |
| | | Assignment | Self-learning |
| | | Quiz | Department-level continuous assessment |
| | External | AKTU University Examination | University-level Assessment |
| Practical | Internal | Lab Experiment | Hands-on-learning continuous assessment |
| | | Practical records | Solution representation assessment |
| | | Internal Practical assessment | Semester-end department-level learning assessment |
| | External | AKTU external practical assessment | Semester-end university-level learning external assessment |
| | Internal | Summer training presentation/ Mini Project | Self-learning, communication ability and life-long learning assessment |
| | Internal | Seminar | Self-learning and create level assessment |
| | Internal/ External | Project | Self-learning and create level assessment |

Table 3.18: Appropriateness/Relevancy in Indirect Assessment Method

| Indirect Assessment Method for PO/PSO | Appropriateness/Relevancy in Assessment |
|---|---|
| Program exit survey | To assess program level outcome from final year student. |
| Alumni exit survey | To assess program level outcome at work and life-long learning. |
| Parents | To assess program outcome satisfaction of the parent. |

- Direct assessment evaluation parameter value will collect from their respective assessment methodology.
- Indirect assessment evaluation parameter value will collect from respective surveys.
- To calculate the overall course outcome attainment, direct and indirect evaluation proportion, set by the central planning committee, equally applicable at department level, will utilize.
- Institute/department level committee will take necessary action if any course outcome shortfall.

## 3.14 Process to find out the program outcome attainment of theory subject:

Step 1: Collect final CO attainment level of respective course.

Step 2: Collect PO/PSO consistency matrix of respective course. Step

3: Calculate average of each PO using following formula

$$PO_i = \text{Average of } CO_{ij}$$

Where $PO_i$ is ith Program Outcome

$CO_{ij}$ is jth CO PO matrix level for ith PO

Step 4: Calculate each PO attainment level using following formula

Direct Attainment level of $PO_i$ = (Average COs for $PO_i$ /3) * Final CO attainment for the course.

Direct Attainment level of $PSO_i$ = (Average COs for $PSO_i$ /3) * Final CO attainment for the course.

Step 5: Collect Program exit survey, alumni survey and parent's survey representing PO/PSO opinion on 10-point scale.

Step 6: find the average of each PO opinion and find indirect PO attainment level using rubric.

Table 3.19: Rule for Internal Assessment ( For Theory Subjects)

| Rule for Internal Assessment ( For Theory Subjects) | Level |
|---|---|
| ITST1 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| ITST2 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| ITST3 Percentage of students above the ITCT Percentage of threshold level proposed by the HOD. | 3 (HIGH) |

Table 3.20: Rule for External Assessment ( For Theory Subjects)

| Rule for External Assessment ( For Theory Subjects) | Level |
|---|---|
| ETST1 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| ETST2 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| ETST3 Percentage of students above the ETCT Percentage of threshold level proposed by the HOD. | 3 (HIGH) |

Table 3.21: Rule ( For Practical's Subjects)

| Rule ( For Practical's Subjects) | Level |
|---|---|
| PST1 Percentage of students above the PCT Percentage of threshold level proposed by the HOD. | 1 (LOW) |
| PST2 Percentage of students above the PCT Percentage of threshold level proposed by the HOD. | 2 (MEDIUM) |
| PST3 Percentage of students above the PCT Percentage of | 3 (HIGH) |

| | |
|---|---|
| threshold level proposed by the HOD. | |

Where:

ITST 1,2,3: Internal Theory Student Threshold (ITST1<ITST2<ITST3)

ITCT: Internal Theory Course Threshold

ETST 1,2,3: External Theory Student Threshold (ETST1<ETST2<ETST3)

ETCT: External Theory Course Threshold

PST 1,2,3 : Practical Student Threshold (PST1<PST2<PST3)

PCT: Practical Course Threshold

Step 7: Calculate final PO attainment level of each PO using formula

$PO_i$ = Direct attainment level of $PO_i$ * 0.8 + indirect PO attainment level of $PO_i$ * 0.2

Table-3.22: Direct and Indirect Assessment Method

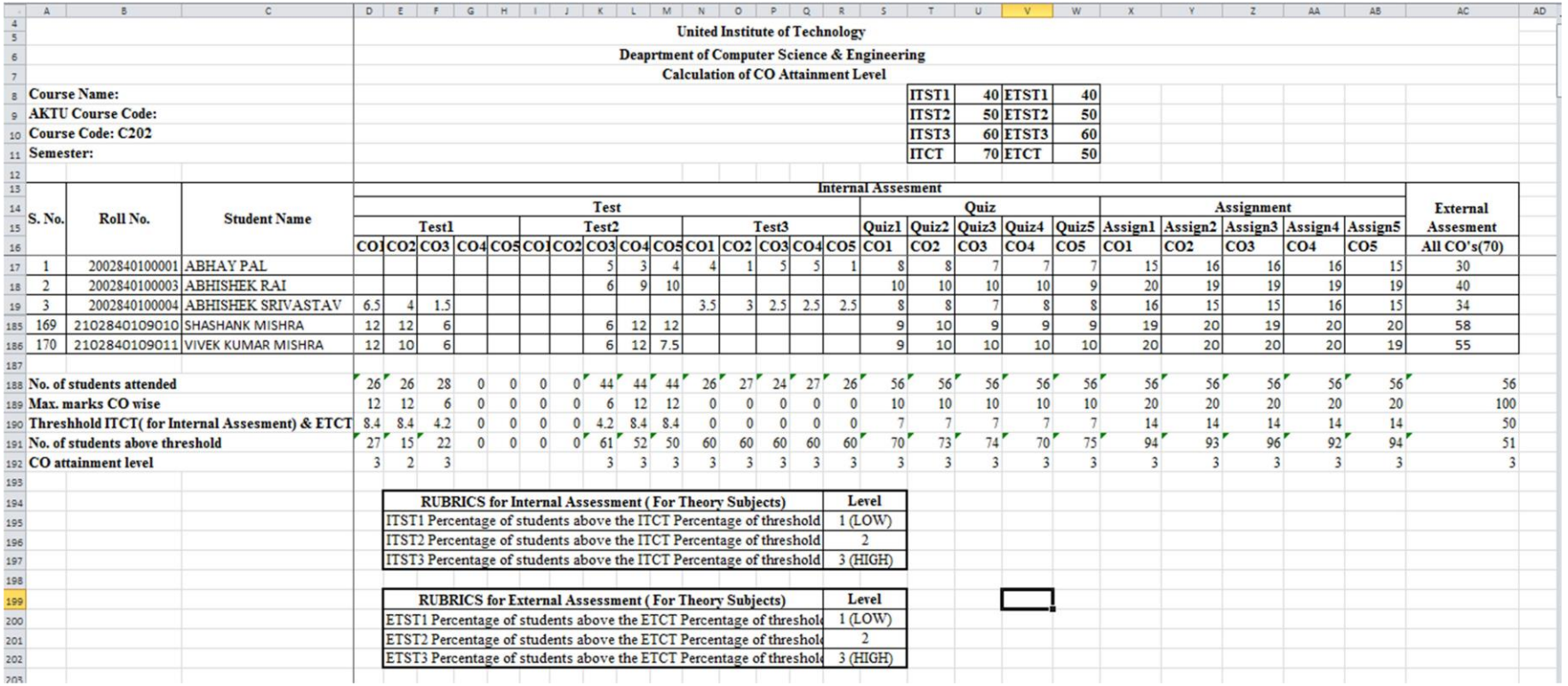
| Assessment Type | Assessment Method | Weightage | Assessment Period | Assessment and Reviewed by |
|---|---|---|---|---|
| Direct | Assessment Tools based on subject nature | 80% | One per semester | Department Advisory Committee |
| | AKTU Examination (67% fpr K-code and 70% for Rcode of University Exam+33% for K-code and 30% for R-code of the Assessment tools)<br>As per AKTU internal, External weightage distribution. | | One per semester | |
| Indirect | Current Passing out Students Survey | 20% | 8th Semester | |
| | Parents survey | | One per year | |
| | Alumni survey | | One per year | |

# 4 Summary Attainment Process

| Steps | Description |
|---|---|
| Step 1 | Define the Vision and Mission of the Department in line with Institute's Vision and Mission. |
| Step 2 | Define the Program Educational Objectives (PEOs) of the Department. |
| Step 3 | Establish the mapping between PEOs and POs to setup target level of PO attainment |
| Step 4 | Define the relation between Course Outcomes (COs) and POs for each course to obtain overall CO mapping with each POs. |
| Step 5 | Develop the overall CO-PO mapping matrix for all courses. |
| Step 6 | Computation and construction of overall CO attainment matrix for each course using course assessment tools. |
| Step 7 | Calculation and construction of direct PO attainment matrix using overall COPO mapping matrix and overall CO attainment matrix. |
| Step 8 | Calculation of overall direct PO attainment. |
| Step 9 | Calculation of indirect PO attainment |
| Step 10 | Computation of overall PO attainment |
| Step 11 | Comparison of target level and obtained PO attainment. |

# Annexure 1

## CO Attainment Level



United Institute of Technology

Deaprtment of Computer Science & Engineering

Calculation of CO Attainment Level

Course Name:

AKTU Course Code:

Course Code: C202

Semester:

| | | | |
|---|---|---|---|
| ITST1 | 40 | ETST1 | 40 |
| ITST2 | 50 | ETST2 | 50 |
| ITST3 | 60 | ETST3 | 60 |
| ITCT | 70 | ETCT | 50 |

| S. No. | Roll No. | Student Name | Internal Assesment | | | | | | | | | | | | | | | | | | | | | | | | External Assesment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Test | | | | | | | | | | | | | | Quiz | | | | | Assignment | | | | | | |
| | | | Test1 | | | | | Test2 | | | | Test3 | | | | | Quiz1 | Quiz2 | Quiz3 | Quiz4 | Quiz5 | Assign1 | Assign2 | Assign3 | Assign4 | Assign5 | |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO1 | CO2 | CO3 | CO4 | CO5 | CO1 | CO2 | CO3 | CO4 | CO5 | CO1 | CO2 | CO3 | CO4 | CO5 | CO1 | CO2 | CO3 | CO4 | CO5 | All CO's(70) |
| 1 | 2002840100001 | ABHAY PAL | | | | | | | | 5 | 3 | 4 | 4 | 1 | 5 | 5 | 1 | 8 | 8 | 7 | 7 | 7 | 15 | 16 | 16 | 16 | 15 | 30 |
| 2 | 2002840100003 | ABHISHEK RAI | | | | | | | | 6 | 9 | 10 | | | | | | 10 | 10 | 10 | 10 | 9 | 20 | 19 | 19 | 19 | 19 | 40 |
| 3 | 2002840100004 | ABHISHEK SRIVASTAV | 6.5 | 4 | 1.5 | | | | | | | | 3.5 | 3 | 2.5 | 2.5 | 2.5 | 8 | 8 | 7 | 8 | 8 | 16 | 15 | 15 | 16 | 15 | 34 |
| 169 | 2102840109010 | SHASHANK MISHRA | 12 | 12 | 6 | | | | | 6 | 12 | 12 | | | | | | 9 | 10 | 9 | 9 | 9 | 19 | 20 | 19 | 20 | 20 | 58 |
| 170 | 2102840109011 | VIVEK KUMAR MISHRA | 12 | 10 | 6 | | | | | 6 | 12 | 7.5 | | | | | | 9 | 10 | 10 | 10 | 10 | 20 | 20 | 20 | 20 | 19 | 55 |
| No. of students attended | | | 26 | 26 | 28 | 0 | 0 | 0 | 0 | 44 | 44 | 44 | 26 | 27 | 24 | 27 | 26 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 |
| Max. marks CO wise | | | 12 | 12 | 6 | 0 | 0 | 0 | 0 | 6 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 10 | 20 | 20 | 20 | 20 | 20 | 100 |
| Threshhold ITCT( for Internal Assesment) & ETCT | | | 8.4 | 8.4 | 4.2 | 0 | 0 | 0 | 0 | 4.2 | 8.4 | 8.4 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 50 |
| No. of students above threshold | | | 27 | 15 | 22 | 0 | 0 | 0 | 0 | 61 | 52 | 50 | 60 | 60 | 60 | 60 | 60 | 70 | 73 | 74 | 70 | 75 | 94 | 93 | 96 | 92 | 94 | 51 |
| CO attainment level | | | 3 | 2 | 3 | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

| RUBRICS for Internal Assessment ( For Theory Subjects) | Level |
|---|---|
| ITST1 Percentage of students above the ITCT Percentage of threshold | 1 (LOW) |
| ITST2 Percentage of students above the ITCT Percentage of threshold | 2 |
| ITST3 Percentage of students above the ITCT Percentage of threshold | 3 (HIGH) |

| RUBRICS for External Assessment ( For Theory Subjects) | Level |
|---|---|
| ETST1 Percentage of students above the ETCT Percentage of threshold | 1 (LOW) |
| ETST2 Percentage of students above the ETCT Percentage of threshold | 2 |
| ETST3 Percentage of students above the ETCT Percentage of threshold | 3 (HIGH) |

Annexure 2

Final CO Attainment for the Course

**United Institute of Technology**

**Deaprtment of Computer Science & Engineering**

**Calculation of Final CO Attainment for the Course**

**Course Name:** **Semester:**

**AKTU Course Code:** **Course Code: C**

| CO's | Internal Assesment | | | | | | | | | | | | | | External Assesment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Test | | | Quiz | | | | | Assignment | | | | | Average of internal CO attainment | University exam. CO attainment |
| | Test1 | Test2 | Test3 | Quiz1 | Quiz2 | Quiz3 | Quiz4 | Quiz5 | Assign1 | Assign2 | Assign3 | Assign4 | Assign5 | | |
| CO1 | 3 | | 3 | 3 | | | | | 3 | | | | | 3.00 | 3 |
| CO2 | 2 | | 3 | | 3 | | | | | 3 | | | | 2.75 | 3 |
| CO3 | 3 | 3 | 3 | | | 3 | | | | | 3 | | | 3.00 | 3 |
| CO4 | | 3 | 3 | | | | 3 | | | | | 3 | | 3.00 | 3 |
| CO5 | | 3 | 3 | | | | | 3 | | | | | 3 | 3.00 | 3 |
| Internal / External CO attainment | | | | | | | | | | | | | | 2.95 | 3.00 |
| Weightage(%) | | | | | | | | | | | | | | 33 | 67 |
| CO Attainment for the Course | | | | | | | | | | | | | | 0.9735 | 2.01 |
| Final CO Attainment for the Course | | | | | | | | | | | | | | 2.9835 | |

Annexure 3

CO-PO/PSO Matrix and PO/PSO Attainment by Direct Method

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | **CO-PO/PSO Matrix and PO/PSO Attainment by Direct Method** | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | **Course Name:** | | | | | | | | | | | | | **Semester:** | | |
| 6 | **AKTU Course Code:** | | | | | | | | | | | | | **Course Code: C** | | |
| 7 | | | | | | | | | | | | | | | | |
| 8 | **CO/PO-PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| 9 | **CO1** | 2 | 3 | 3 | 2 | 2 | | | | | | | 2 | | 1 | 1 |
| 10 | **CO2** | 3 | 3 | 3 | 2 | 3 | | | | | | | 2 | | 3 | 3 |
| 11 | **CO3** | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | | 3 | 3 |
| 12 | **CO4** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | | 3 | 3 |
| 13 | **CO5** | 2 | 3 | 3 | 2 | 3 | | | | | | | 3 | | 2 | 2 |
| 14 | | | | | | | | | | | | | | | | |
| 15 | **Average of CO's for PO's/PSOs** | 2.60 | 3.00 | 3.00 | 2.40 | 2.80 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 2.40 | #DIV/0! | 2.40 | 2.40 |
| 16 | | | | | | | | | | | | | | | | |
| 17 | **PO/PSO Attainment** | 2.5857 | 2.9835 | 2.9835 | 2.3868 | 2.7846 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 2.3868 | #DIV/0! | 2.3868 | 2.3868 |
| 18 | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | |
| 20 | **PO attainment is calculated by following formula** | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | |
| 22 | **PO attainment = (Average of CO's for PO/3) * Final CO attainment for the course** | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | |
| 24 | **PSO attainment is calculated by following formula** | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | |
| 26 | **PSO attainment = (Average of CO's for PSO/3) * Final CO attainment for the course** | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | |

Annexure 4

# UNITED INSTITUTE OF TECHNOLOGY, PRAYAGRAJ

## ...NT OF COMPUTER SCIENCE AND ENGINEERING

## ALUMNI FEEDBACK FORM (SESSION 2021-22)

Branch:……..Passing Year:…….Date……

Student Name:…….....Mob.No…….……

Given your response by making (□) on any column (from 1 to 10) against each point. (Column 10 stands for Excellent or outstanding and column 1 stands for poor or unsatisfactory) Remark: Parameters are based on defined PO & PSO.

| S No | Points to be considered | Response | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | How do you rate the knowledge of Mathematics, Physics, Chemistry and basic Engineering to solve Engineering Works? | | | | | | | | | | |
| 2 | How do you rate your ability to identify, formulate and analyze complex Engineering problems? | | | | | | | | | | |
| 3 | How do you rate your ability to design efficient processes and develop high quality products giving due consideration to safety, environmental issues and economic aspects? | | | | | | | | | | |
| 4 | How do you rate your ability to conduct investigation of complex Engineering problems? | | | | | | | | | | |
| 5 | Had you acquired skills to select and use modern Engineering tools and Software for Modeling, Simulation and solution of Complex Engineering problems? | | | | | | | | | | |
| 6 | Do you able to apply contextual knowledge to assess social, health, safety, legal and cultural issues in professional practice to become a responsible engineer? | | | | | | | | | | |
| 7 | Do you able to understand the social and environmental impacts of applying Engineering to solve real life problems and practice sustainable development? | | | | | | | | | | |
| 8 | How do you rate your ability to work with full commitment to professional and ethical responsibilities as an engineer? | | | | | | | | | | |
| 9 | How do you rate your ability to work individually in a team or as a leader in any demanding or challenging environment? | | | | | | | | | | |
| 10 | How do you rate your ability to communicate effectively with Engineering community or the society at large through appropriate reports, designs, presentations and instructions? | | | | | | | | | | |
| 11 | Do you able to engage in life-long learning in the broadest context of developments in technology for continuous Professional development? | | | | | | | | | | |
| 12 | Are you able to understand Engineering and Management principles and apply these to manage multidisciplinary projects and finance as an individual or as a member or leader of a team? | | | | | | | | | | |
| 13 | How do you rate your ability to apply the knowledge of Programming languages, Data, Structure and Algorithms, Data Science, Networks and Software Engineering principles for Software product development? | | | | | | | | | | |
| 14 | How do you rate your ability to apply the knowledge of Mathematics, Physics, Chemistry and basic Engineering to solve Engineering problems? | | | | | | | | | | |
| 15 | How do you rate your ability to identify, formulate and analyze complex Engineering problems and derive meaningful conclusions using principles of Mathematics, Science and Engineering? | | | | | | | | | | |

Annexure 5

Place: Signature



UNITED INSTITUTE OF TECHNOLOGY, PRAYAGRAJ

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRENT PASSING OUT STUDENT FEEDBACK FORM

Branch:……..Year/Section:……..

Date……..

Student Name:…….Roll. No.……Mob. No.……..

Given your response by making (□) on any column (from 1 to 10) against each point. (Column 10 stands for Excellent or outstanding and column 1 stands for poor or unsatisfactory) Remark: Parameters are based on defined PO and PSO.

| S No | Points to be considered | Response | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Have you learned the fundamental principles underlying the major areas of Mathematics, Science and Engineering in your courses? | | | | | | | | | | |
| 2 | Are you able to analyze a problem and formulate the solution using principles of Mathematics, Natural Science and Engineering Science? | | | | | | | | | | |
| 3 | Have you published any paper using innovative ideas considering public health, safety and social environmental issues during your graduation? | | | | | | | | | | |
| 4 | Do you able to use research based knowledge and methods to investigate complex problems? | | | | | | | | | | |
| 5 | Have you used creative thinking Modern tools techniques and resources for solutions to complex Engineering activities keeping the constraints in mind? | | | | | | | | | | |
| 6 | Do you able to reason out issues related to society, health, safety, legal and culture using contextual knowledge and borne the responsibility relevant to professional Engineering discipline to address the same? | | | | | | | | | | |
| 7 | Are you able to grasp the impact of professional Engineering solutions in the context of society and environment and apply it for sustainable development? | | | | | | | | | | |
| 8 | Are you able to apply ethical principles and commitment to professional ethics and responsibilities | | | | | | | | | | |
| 9 | Are you a team player and able to function effectively in a multidisciplinary setting? | | | | | | | | | | |

Annexure 6

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Are you able to communicate effectively on complex Engineering activities with the Engineering communities and the society? | | | | | | | | | | |
| 11 | Are you able to apply knowledge and skill to manage projects in a multi-disciplinary environment? | | | | | | | | | | |
| 12 | Are you able to keep yourself updated on the latest technology to adhere in your workplace? | | | | | | | | | | |
| 13 | Are you able to work in operation and maintenance services in Software Development Industry? | | | | | | | | | | |
| 14 | Are you able to apply basic principles of Engineering science to engage yourself in national level research? | | | | | | | | | | |
| 15 | Have you used creative thinking to design software? | | | | | | | | | | |

Place: Signature



# UNITED INSTITUTE OF TECHNOLOGY, PRAYAGRAJ

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING PARENT FEEDBACK FORM

Parent Name:…….. Mob. No…….
Date…….. .
Student Name:…… Branch…….Study Year:……

Given your response by making (□) on any column (from 1 to 10) against each point.
(Column 10 stands for Excellent or outstanding and column 1 stands for poor or unsatisfactory)
Remark: Parameters are based on defined PO & PSO.

| S No | Points to be considered | Response | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | How well your ward has been able to apply the knowledge of Mathematics, Physics, Chemistry and basic engineering to solve Engineering problems? | | | | | | | | | | |
| 2 | How well your ward has been able to identify, formulate and analyze complex Engineering problems and derive meaningful conclusions using principles of Mathematics, Science and engineering in your work? | | | | | | | | | | |
| 3 | How well your ward has been able to design efficient processes and develop high quality products giving due consideration to safety, environmental issues and economic aspects? | | | | | | | | | | |
| 4 | How well your ward has been able to conduct investigation of complex Engineering problems? | | | | | | | | | | |
| 5 | How well your ward has been able select and use modern engineering tools and software for modeling, simulation and solution of complex Engineering problems? | | | | | | | | | | |

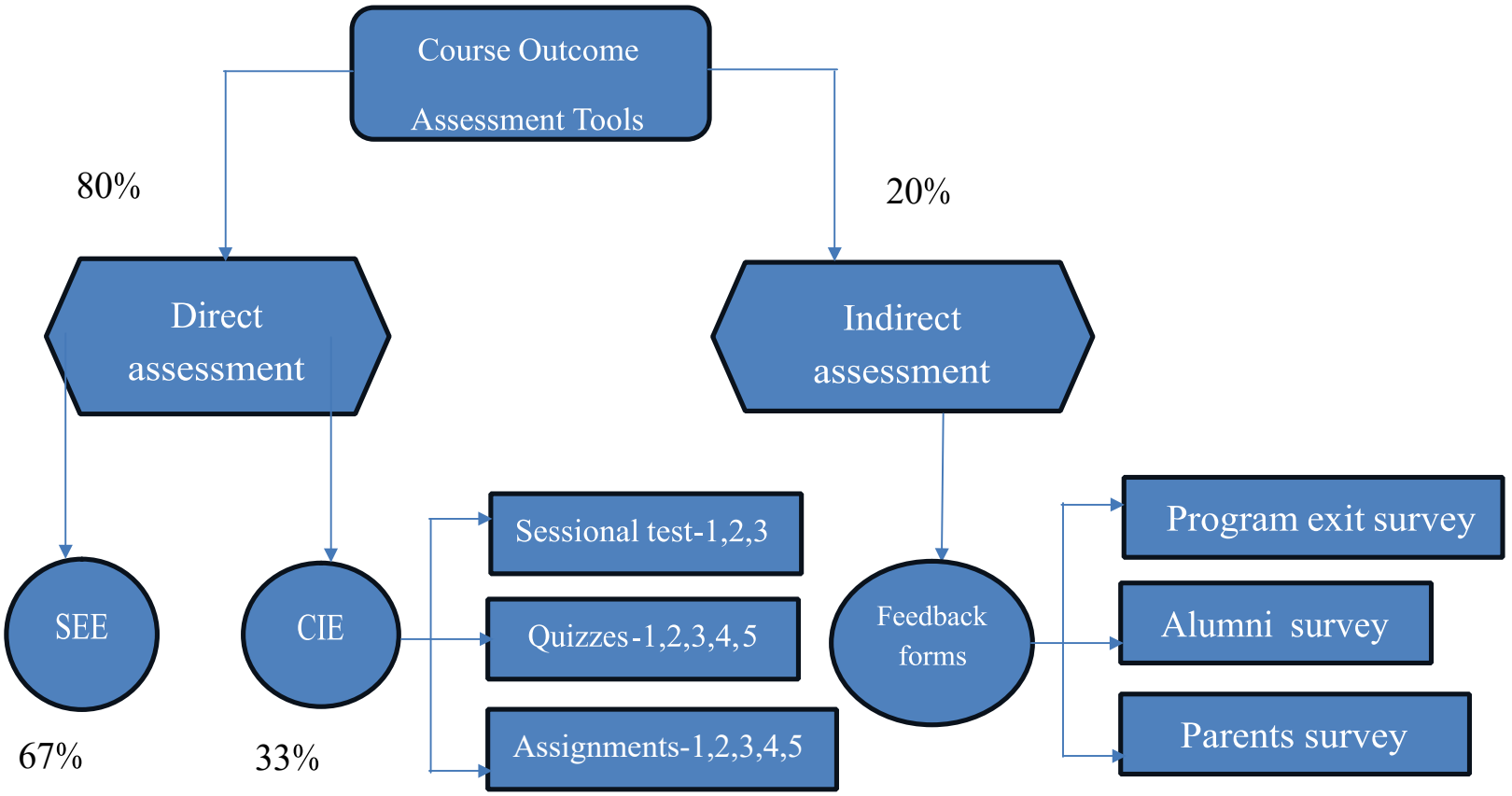
Annexure 7

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | How well your ward has been able to apply contextual knowledge to assess societal, health, safety, legal and cultural issues in professional practice to become a responsible engineer? | | | | | | | | | | |
| 7 | How well your ward has been able to understand the societal and environmental impacts of applying Engineering to solve real life problems and practice sustainable development? | | | | | | | | | | |
| 8 | How well your ward has been able to work with full commitment to professional and ethical responsibilities as an engineer? | | | | | | | | | | |
| 9 | How well your ward has been able to work individually in a team or as a leader in any demanding or challenging environment? | | | | | | | | | | |
| 10 | How well your ward has been able to communicate effectively through written and oral modes to all levels of stakeholders in society. | | | | | | | | | | |
| 11 | How well your ward has been able to apply engineering and management principles to manage multidisciplinary projects as an individual or as a team member or team leader? | | | | | | | | | | |
| 12 | How well your ward has been engaging himself in life-long learning and developments in technology for continuous professional development? | | | | | | | | | | |
| 13 | How far your ward has been able to provide effective and efficient real time solution to engineering problems in his area, based on acquired knowledge so as to empower industry and society? | | | | | | | | | | |
| 14 | How far your ward has been able to channelize his knowledge base, business links and social contacts into socially beneficial activities? | | | | | | | | | | |
| 15 | How far your ward is in a position to pursue continual path of professional development, interspersed with advanced education and continuing enhancement programs, relevant to his specific career goals? | | | | | | | | | | |

Place: Signature

Annexure 7

Theory Course Assessment Process



Annexure 8

Practical Course Assessment Process