

7.2.1. Best Practice I

Title of the Practice:

System and Process of Effective Implementation of OBE

Objective of the Practice:

To ensuring graduating engineers from all programs demonstrate expected skill (Knowledge, Skills, Abilities or Attitudes) and competency leading to their global recognition. This task towards global recognition of our graduates became easy, as the expected global attributes were embedded through the Program Outcomes (POs), defined by the National Board of Accreditation (NBA). Hence, all activities on campus (academic, activities beyond curriculum, co-curricular and extra-curricular) were focused on developing the POs leading to an effective implementation of Outcomes Based Education (OBE), as it would then lead to global recognition of our graduates.

The Context:

Traditionally, higher education in India has been examination-oriented. The students were expected to pass examinations and get a degree. There was a poor link between education and employability. As a result, a large number of graduates had poor employability. Students would mug up information delivered in a course without acquiring skills to apply it in a real-life setting. Grades were more important than learning. Students thus focussed on grades, not learning. Input-based model of education focussed on delivery of information, infrastructure, and resources. Accordingly, higher education institutions depended on institutional activities and faculty behaviour. Students were seen as empty vessels to be filled with information. It did not help students and they were dissatisfied with education. Student centricity was conspicuous by its absence. Outcome based education (OBE) questions the traditional model of education and puts the student at the heart of all educational activities. It emphasis on what students do in the classroom and what they would be able to do after undergoing a programme. The teacher is a facilitator who supports each student to achieve his learning outcomes. Consequently, all educational activities

– curriculum, delivery, assessment, and co-curricular activities – have undergone a 180-degree change. In the OBE, the focus of education is on dealing with real-life problems and student support. The development of programme learning outcomes is the first step in outcome-based education. It decides curricular, co-curricular, and extra-curricular activities. It also decides the choice of the courses and the syllabus of each course. In the same vein, assessment activities are related to course outcomes, hence to programme outcomes. Another important feature of the OBE is continuous improvement through Assurance of Learning.

The Practice:

- Establishment of Process for defining vision and Mission statement of Institution and Department.
- Defining Program Specific Outcome based on the Graduate attributes (POs) given by NBA.
- Defining Course Outcomes (COs) based on the Blooms knowledge level and mapping of COs with POs using Bloom Taxonomy.
- Establish the Assessment and Evaluation pattern by using following method.
 - Diagnostic Assessment - Analyzing Prerequisite knowledge or analyzing the knowledge transfer during the course.
 - Formative Assessment – forms or helps the learning outcome during the course. (planned assessments and informed well in advance to the students). The following are some of the common formative assessment tools used in addition with the traditional cycle test /unit test systems/ assignments are: 1. On the spot Questions with space for answering, 2. Match the following, 3. Think – Pair – Share, 4. 3-2-1 Learning, 5. Jumbled sentences / words, 6. Flash cards, 7. 1 Minute Paper, 8. Step Ladder Tool, 9. Multiple choice question, 10. Quiz, 11. Flipped Class room, 12. Group seminar, 13. Role Play, 14. Chart Preparation / Model Making, 15. Feedback through survey forms from students after Test
 - Summative Assessment – total or sum at the final exam which has higher weightage.

- Initiatives to improve instruction methods to focus on student centric learning: 1. Interactive classrooms, 2. Design thinking to optimize student learning , 3. Focused group study ,4. Simulation classes and labs, 5. ICT usage, 6. Problem based learning: Student-directed learning, 7. Flipped classroom, 8. Away from rote learning, 9. Develop lifelong learning attitude, 10. Web based learning, 11. Presentations, 12. Soft skill classes for personality development, 13. Pedagogical Initiatives, 14. Quality of Laboratory Experiments, 15. Weak and bright students support system.
- To Assess the CO and PO attainment by using In House CO & PO attainment calculation tool.
- Revision of Course target, CO statement and teaching learning pedagogy for the next batch of students based on course closure report which was given by the course handling faculty members and feedback from the students.

Evidence of Success:

- As a part of the implementation of the OBE, programme design, delivery, and assessment have been changed.
- Enhanced quality of project
- Enhanced Professional body activities (both quality and quantity)
- Enhanced number of awards secured by students in National and International technical competitions/professional body activities.
- Improve Student graduation percentage.
- Enhanced ON/OFF campus placement.
- Continuous improvement in the average and highest pay package offered

Problems Encountered and Resources Required:

- OBE implemented in the campus from January 2017. Faculty members have faced a problem to adopt OBE from traditional method of teaching. So, they need training.
- Student engagement for outcome-oriented learning in the classroom is a challenging task.

- Collecting the data for indirect assessment methods, like Student Exit Survey, Student Satisfaction Survey, and Employer Survey is time consuming

Outcome-Based Education (OBE) – Guiding Principle Manual

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Outcome-Based Education (OBE)

Introduction

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

It is student-centered instruction model that emphasizes on gauging student performance through outcomes. Outcomes comprise information, skills and approaches. Its attention remains on assessment of consequences of the program by stating the information, ability and performance a ex-student is predictable to reach upon completion of a program and few years of graduation. In the OBE model, the compulsory knowledge and skill sets for a specific degree is prearranged and the students are appraised for all the required limits at the time of the course of the program.

The OBE model deals with the progress of the graduate in **three parameters**, they are

- **Program Educational Objectives (PEO)**
- **Program Outcomes (PO)**
- **Course Outcomes (CO)**

Principles of OBE:

- Clarity of focus (having specific outcomes gives a strong sense of purpose to everything teachers and students do).
- Design down, deliver up (when planning curriculum, educators start with the outcomes and work backwards; when planning instruction, teachers teach what students need to learn to demonstrate the outcomes).
- High expectations (OBE departs from traditional education in its assumption that all students can learn well—although not in the same way and not necessarily on the same day), an.
- Expanded opportunities (students must be permitted to demonstrate their learning in different ways, and they must have numerous opportunities to demonstrate the outcomes)

Steps in Implementing OBE

For successful implementation of OBE system the following parameters are to be defined clearly with help of feedback from industrial and professional bodies.

A. Institutional Requirements

- Clear vision and mission statement of the institution stating the core values, business values and ethical values
- Vision and mission statement should entrust the stakeholders and learning committee.

B. Program Requirements

- With feedbacks from industrial and professional bodies to develop the curriculum for the particular course
- Developing Program outcomes (PO).
- Mapping PO with institutions vision and mission

C. Course outcomes

- Refining curriculum with determining the order of courses and defining the prerequisite for each courses.
- Developing course outcomes for each course,
- Setting a threshold for assessment for courses for determining course attainment.

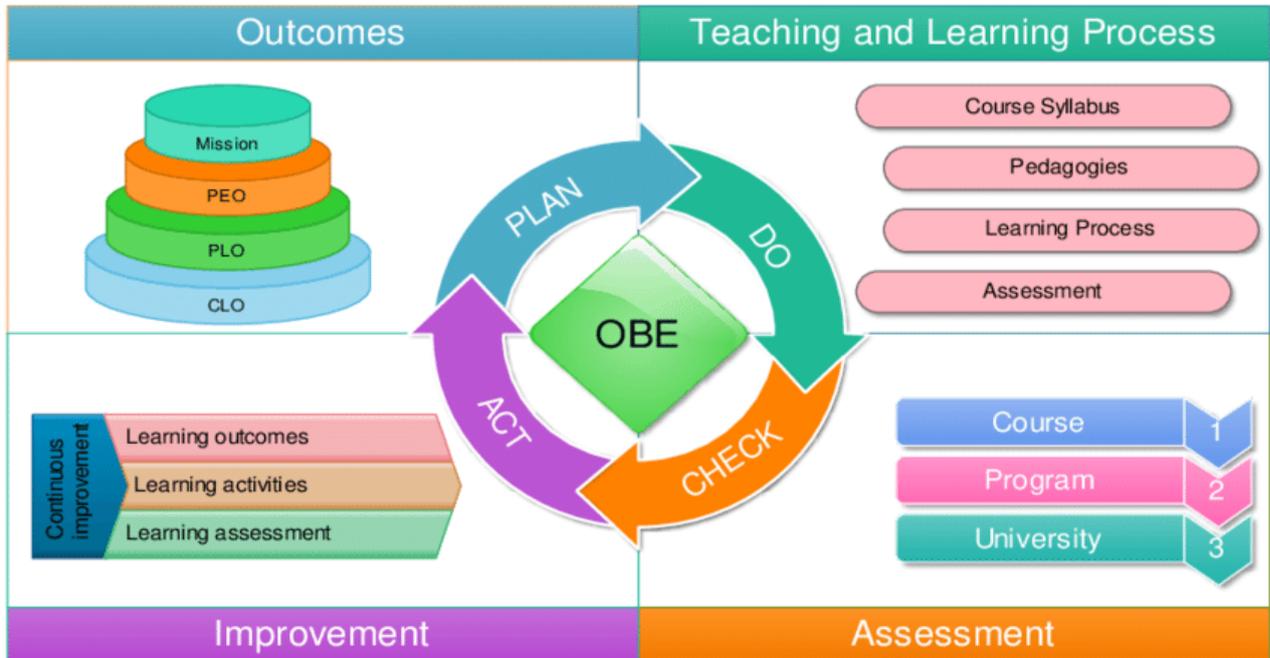
D. Assessment & Evaluation

- Clearly defining the results to be measured
- Identifying the data and resources availability and utilizing assessment related to the course
- Each assessment should have a clear rubrics which can imply how marks can be achieved
- When the marks are shown to the students after validating it, the students understand the area where they are lacking and can focus on that area to improve.

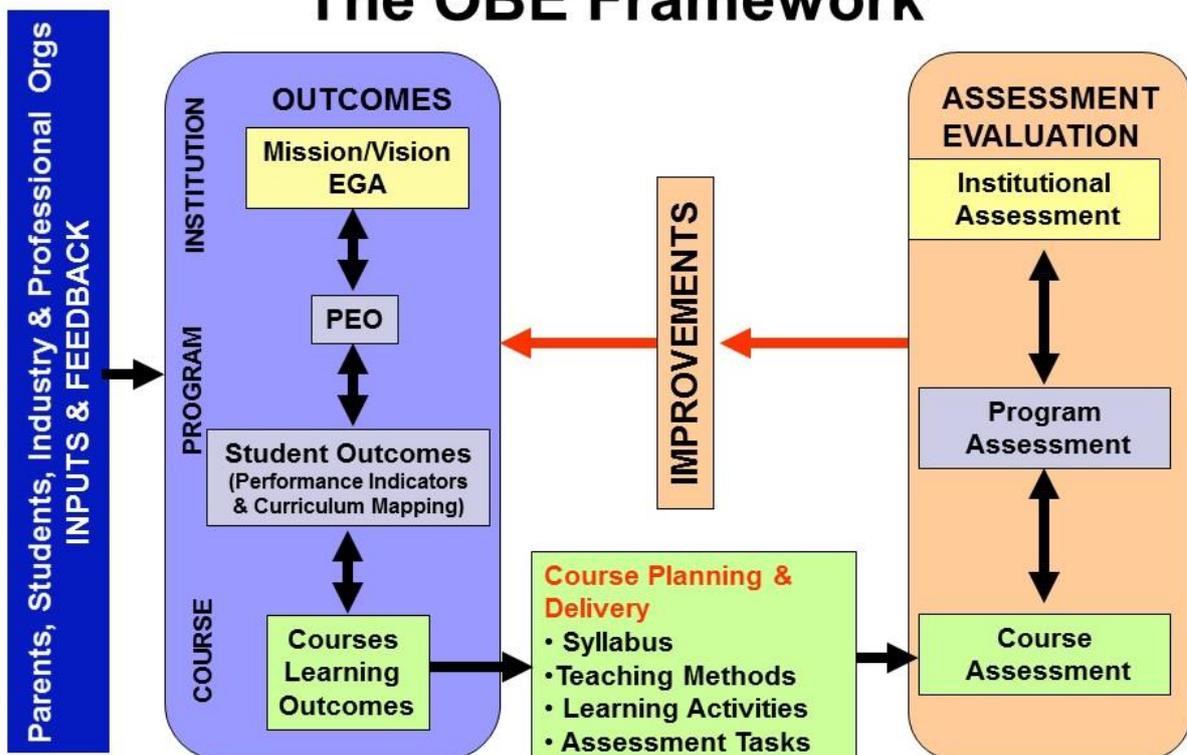
E. Continual Quality Improvement

The Outcome Based Education (OBE) practice requires the continual quality improvement (CQI) process in order to continuously improve the quality of teaching and learning of an education program. In purpose of implementing CQI processes, the inputs from the program stakeholders consist of external assessors, industry advisory panel (IAP), students as well as accreditation panel should be considered, weighted and implemented by the department. The

program external assessors' inputs also will determine the quality of the program's curriculum and contents as benchmarked with other top international universities.



The OBE Framework



Steps Implemented for OBE in KCET

A.1 Vision and Mission of the Institute

Vision and Mission statement of the Institute	
Vision of the Institute	To make this Institution, the unique of its kind in the field of Research and Development activities in this part of world.
Mission of the Institute	To impart highly innovative and technical knowledge to the urban and unreachable rural student folks through “ Total Quality Education ”.

A.2 Process for defining the Vision and Mission of the department, and PEOs of the program.

The Process for Defining Vision and Mission of the Program involves the following steps.

Step 1: Vision and Mission of the institute are taken as basis.

Step 2: Vision and Mission of the Department are framed at department level in consistent with Institution’s Vision & Mission statements. At this level, Head of the Department and the department faculty members are involved in the process.

Step 3: The framed statements are forwarded to the Governing Council (GC) for approval.

Step 4: The approved statements are disseminated by the Department through appropriate Media and Program.

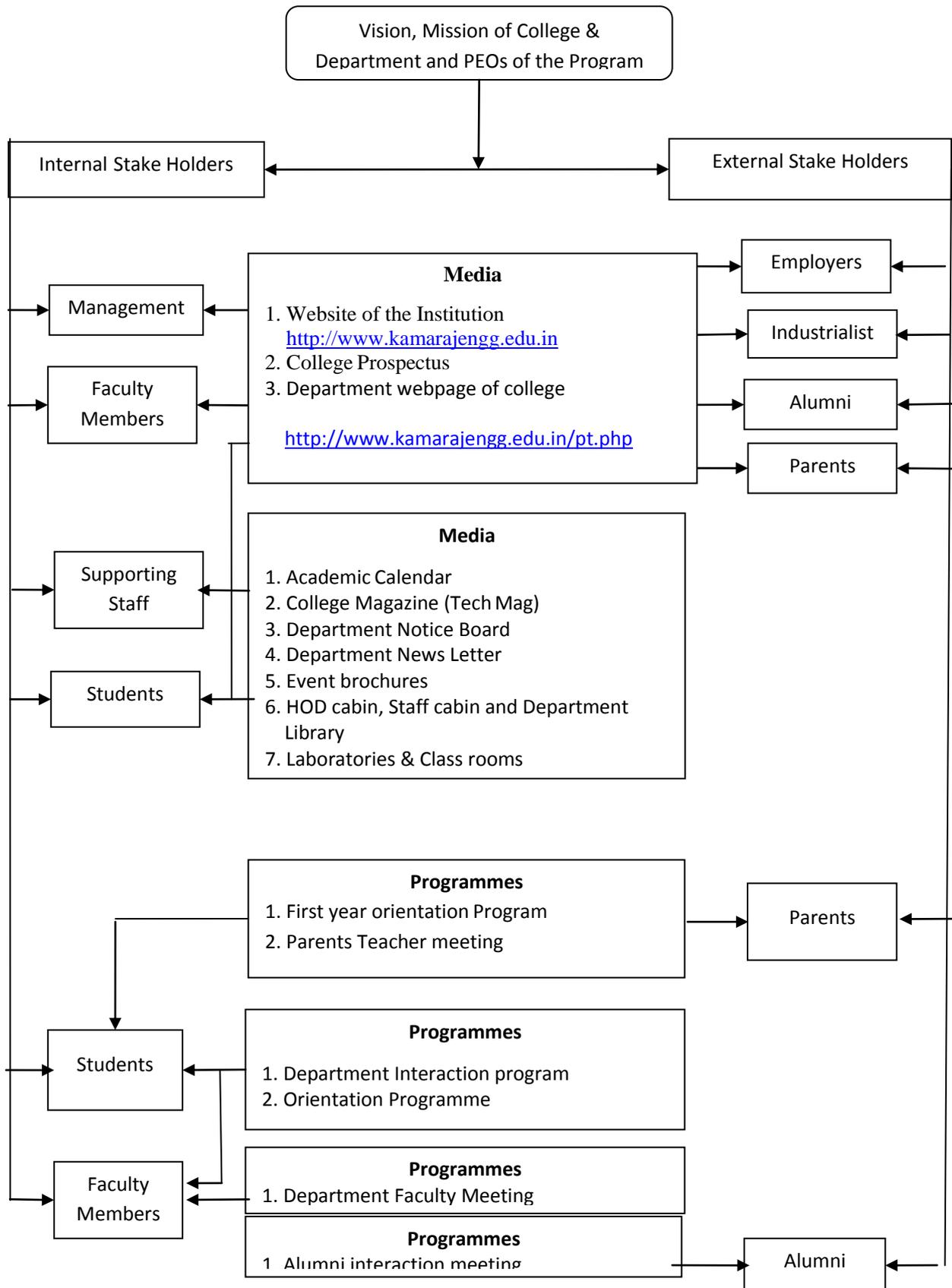


Figure: Process of dissemination of Vision and Mission of the College and Department & PEOs of the Program

The process for defining the PEOs of the Program involves the following steps:

Step 1: Vision & Mission of the Department are taken as basis.

Step 2: PEOs of the Program are framed at the department level in consistent with Department's Vision & Mission. At this level, Head of the department and the department faculty members are involved in the Process.

Step 3: The framed statements are discussed and reviewed in the Program Assessment Committee Meeting. Then the necessary modifications are made based on the suggestions received from the committee members

B. OUTCOMES

B. 1. PROGRAM OUTCOMES (POs)

Program Outcomes (POs) describe what students should know and be able to do at the end of the Program. They are to be in line with the graduate attributes of NBA. POs are to be specific, measurable and achievable. POs transform the PEOs into specific student performance and behaviours that demonstrate student learning and skill development.

The Various dimensions of Program Outcomes are

Knowledge Outcomes	:	Pertain to grasp of fundamental cognitive content, core concepts, basic principles of inquiry, a broad history
Skills Outcomes	:	focus on capacity for applying basic knowledge, analyzing and synthesizing information, assessing the value of information, communicating effectively and collaborating
Attitudes and Values outcome	:	Encompass affective states, personal/ professional/ social values and ethical principles
Behavioral Outcomes	:	Reflect a manifestation of knowledge, skills and attitudes as evidenced by performance and contributions.

The list of Graduate attributes given by NBA is as follows:

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.

11. **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.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. 2. PROGRAM SPECIFIC OUTCOME (PSO)

In addition to the General Criteria, each Program must satisfy a set of criteria specific to it known as Program Specific Outcome which deal with the requirements for engineering practice particular to the related sub-discipline. The stipulations in the Program Specific Outcome chiefly concern curricular issues and qualifications & competencies of faculty. The Program curriculum is to be provided in correlation with the Program specific outcome. The institution shall provide evidence that the Program curriculum satisfies the Program specific outcome, and industry specific criteria and industry interactions/ internship. In general, PSO statements are Program specific which is derived based on the strength of the Program.

A sample of Mechanical Engineering department PSOs are given below.

1. Graduates will be able to create and analyse the Research and Development activities related to design and manufacturing.
2. Graduates will be able to design, develop need based products in Mechanical Engineering and allied Industries.

C.3. COURSE OUTCOMES (COs)

Course Outcomes (COs) are clear statements of what a student should be able to demonstrate upon completion of a course. They should be assessable and measurable knowledge, skills, abilities or attitudes that students attain by the end of the course. In general, around 4 to 6 course outcome statements are written for each course.

C.1 Framing COs

All courses in a particular Program would have their own course outcome statements. These course outcomes are designed based on the requirement of the Program outcomes (POs). Each course outcomes are mapped to a relevant POs based on the Blooms knowledge level for each POs and COs. The teaching learning process and assessment methods are to be designed in such a way to achieve the COs. It is important to ensure that the student is able to acquire the knowledge or skill required.

COs are written in such a way that it should satisfy the following points:

- The course outcomes must state the major knowledge, skills, attitude or ability that students will acquire.
- Course outcomes should be expressed in terms of measurable and/or observable behaviours
- Course Outcomes should be agreed upon by the faculty in a Program and should drive Program outcomes.
- Course outcomes should begin with an action verb (e.g., write, install, solve, and apply).

A sample course is given here (B.E. Mechanical engineering, VI semester)

Course Name: Design of Transmission Systems

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues

UNIT I : DESIGN OF FLEXIBLE ELEMENTS

Design of Flat belts and pulleys – Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II : SPUR GEARS AND PARALLEL AXIS HELICAL GEARS

Speed ratios and number of teeth-Force analysis -Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT III : BEVEL, WORM AND CROSS HELICAL GEARS

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES

Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box – Design of multi speed gear box for machine tool applications – Constant mesh gear box – Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes – external shoe brakes – Internal expanding shoe brake.

A sample course statements are given below

Course : Design of Transmission Systems

COURSE OUTCOME: At the end the course the students should be able to

CO	CO Statements	Knowledge Level
C310.1	Select the flexible elements such as V-Belts, flat belts, ropes, chains for power transmission.	K4 analyze
C310.2	Calculate the design parameters of spur gear and helical gears.	K3 - apply
C310.3	Design the bevel worm, and helical gears used in transmission systems.	K3 – apply
C310.4	Develop the design for constant speed and variable speed gear boxes.	K3 - apply
C310.5	Create the design of cams, clutches and Brakes.	K3 - apply

CO Knowledge level depends on

- Teaching learning process used
- Application questions involved
- Type of assessment used

Blooms taxonomy action verbs of lower cognitive level can also be used as higher cognitive level. It depends on TL & type of assessment used

C. 2 Mapping of CO with POs

Correlation between POs and COs has to be established. For example, the courses mentioned above are given for illustration.

POs	COs and their correlation
<p>Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</p>	<p>C310.1: Select the flexible elements such as V-Belts, flat belts, ropes, chains for power transmission. C310.2: Calculate the design parameters of spur gear and helical gears. C310.3: Design the bevel worm, and helical gears used in transmission systems. C310.4: Develop the design for constant speed and variable speed gear boxes. C310.5: Create the design of cams, clutches and Brakes.</p> <p>Explanation: The students will apply engineering fundamentals, mathematics for appropriate selection and calculation</p> <p>Hence all the COs are strongly correlated with POs</p>
<p>Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</p>	<p>Explanation</p> <ul style="list-style-type: none"> Here first CO, C310.1 is strongly correlated as it involves review of various belt and chain drives and it is required appropriate selection for the load and application. Other COs are moderately contributed as it involves solving the needs by the application of mathematics and engineering fundamentals
<p>Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</p>	<ul style="list-style-type: none"> All the COs are lightly correlated with this POs. here the students are not focused to solve real world problems and it does not involve the various processes and manufacturing. How ever the knowledge gathered here will be applied in mini project and main project.

Like this the correlation was developed and mapping was done. In addition to this the difference in knowledge levels of the COs and POs also helped to write the strong, medium and low correlation. If both the COs and POs have same knowledge then, the CO has strongly correlated with that particular PO provided if that respective CO has relevance with that PO. If the PO knowledge level is higher and CO knowledge level is lower, then that correlation between the CO and that Particular PO is marked as medium or low depending on how much, that CO may reflect that PO in the course.

The following shows the CO-PO mapping of the course C310 – Design of Transmission systems.

CO	Program outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C310.1 (K4)	H	H	M	M	L	H	H	H	H	H	H	L	M	M
C310.2 (K3)	H	M	L	L	-	H	H	H	M	M	H	-	M	M
C310.3 (K3)	H	M	L	L	-	H	H	H	M	M	H	-	L	L
C310.4 (K3)	H	M	L	L	-	H	H	H	M	M	L	-	M	M
C310.5 (K3)	H	M	L	L	-	H	H	H	M	M	H	-	M	M
C310	3	2	1	1	1	3	3	3	2	2	3	1	2	2

H – Substantial or High (3) ; **M** – Moderate or Medium (2) ; **L** – Slight or Low (1)

Initiatives to improve instruction methods to focus on student centric learning:

- Interactive classrooms
- Design thinking to optimize student learning
- Focused group study
- Simulation classes and labs
- ICT usage
- Problem based learning: Student-directed learning
- Flipped classroom
- Away from rote learning
- Develop lifelong learning attitude
- Web based learning
- Presentations
- Soft skill classes for personality development:
- Pedagogical Initiatives
- Quality of Laboratory Experiments
- Weak and bright students support system

S. No	Delivery Methods	Description
1.	Traditional board and chalk method	Typically for courses which are analytical, have mathematical derivations, and conceptual developments, Problem Analysis and solution. By giving analogy simplification of concept, stepwise problem solving, highlighting the important terms
2.	Experimental and simulation studies model making	In laboratories the experiments are designed, data is collected and analyzed for the practical solution using hardware set up or software. The group of students does the task under the supervision of the faculty member. The performance of the students' abilities for completion of the set objectives for the experiment is continuously assessed

		by the faculty member as Term Work and record of the same is maintained in Academic Record Book
3.	Power Point Presentations	For courses rich in having textual and diagrammatic material presentations having multimedia contents such as Graphics, Animation and short video clips. Students are asked to give presentation in class
4.	Live lectures / distance learning mode	Telecast of assorted webinars, Expert lectures, NPTEL courses, Virtual Laboratory Coursework, webinars are arranged for students. The faculty member accompanying the students conducts interaction with the students to confirm the take away. ICT tools enable them to adapt cognitive, affective and behavioral domains. Further the seeds of lifelong learning are also in planted during lectures.
5.	Interactive teaching modes	Such as group discussions, quiz, rigorous assignments are used to improve problem solving capability, critical thinking, control design and analyzing ability. Different questions to different groups to increase inter-personal communication and complete the task in given time.
6.	Industrial visits	To understand the application areas of the curriculum contents interaction of the students and faculty members is organized in every academic term with the industrial expertise in the form of guest lectures and industrial visits
7.	Quiz or MCQ Test	Concept clarity and answer in minimum time to assess cognitive level
8.	Project	The students search recent papers and identify the problem, decide team, Budgeting and planning of work, fabrication of circuit, test the circuit and write the report.

D. ASSESSMENT AND EVALUATION

D.1 Assessment

Assessment and evaluation play vital role in OBE. Effective assessment methods would be helpful in improving the student learning. In particular to the learning process, assessment is the systematic collection and analysis of information to improve student learning.

In OBE, assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program educational objectives, Program outcomes and course outcomes.

The improvement of student learning is the most important focus of assessment. There are three different types of assessment, all of which contribute to the learning process are:

- **Diagnostic Assessment** - Analyzing Prerequisite knowledge or analyzing the knowledge transfer during the course. (represents feedback or unplanned assessment)
- **Formative Assessment** – forms or helps the learning outcome during the course. (planned assessments and informed well in advance to the students)
- **Summative Assessment** – total or sum at the final exam which has higher weightage.

D.1.1 Benefits of Assessment

- Identifying the strength & weakness
- Suggestion for improvement in Teaching – Learning Pedagogy
- Grading the students with respect to a Benchmark

D. 1.2 Types of Formative Assessment Tools

The following are some of the common formative assessment tools used in addition with the traditional cycle test /unit test systems/ assignments are:

1. On the spot Questions with space for answering
2. Match the following
3. Think – Pair – Share

4. 3-2-1 Learning
5. Jumbled sentences / words
6. Flash cards
7. 1 Minute Paper
8. Step Ladder Tool
9. Multiple choice question
10. Quiz
11. Flipped Class room
12. Group seminar
13. Role Play
14. Chart Preparation / Model Making
15. Feedback through survey forms from students after Test

D.2 Evaluation

Evaluation is one or more processes, done by the evaluation team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which learning sequence is used to acknowledge, record and report on students' overall achievement at a given point. It also helps to determine how Program outcomes are being achieved, and results in decisions and actions to improve the Program.

E. ATTAINMENT OF THE COs and POs

E.1 Targets

Targets are set to each assessment based on the suggestions by PAC Committee members, Course Closure reports and feedback from stake holders. Figure E.1 shows the schematic representation of targets and weightages for the attainment of COs. The course instructor has a liberty to choose the relevant and appropriate assessment tool.

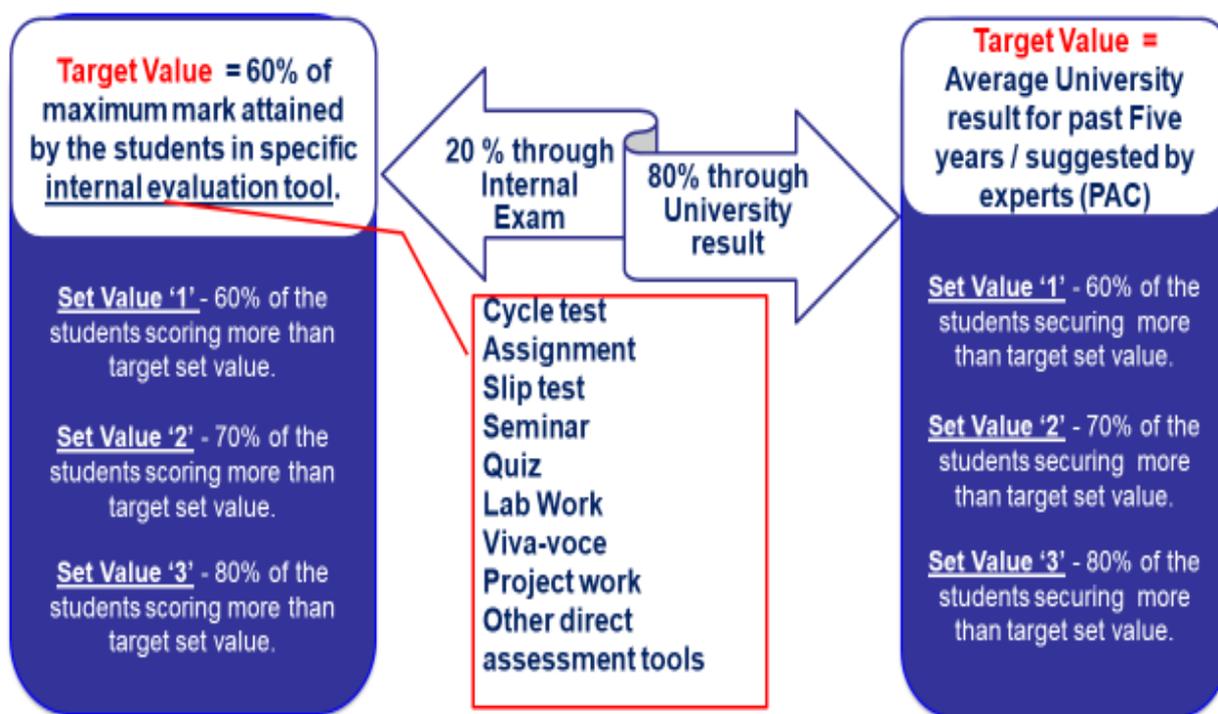


Figure E.1 – Schematic representation of targets and weightages for the attainment of COs.

Table E.1 - List of Assessment tools and their relevance used

Blooms K – Levels		List of assessment tools
K1	Remember	1. Internal test 2. Class test 3. Match the following/ one-minute card (Learning outcome of the session as required by instructors)

Blooms K – Levels		List of assessment tools
K2	Understand	<ol style="list-style-type: none"> 1. Collaborative Learning (Seminars, etc.,) 2. Problem Solving 3. Internal test 4. Assignments
K3	Apply	<ol style="list-style-type: none"> 1. Group Discussion 2. Role Play 3. Problem Solving (GATE Questions) 4. Laboratory Work 5. Internal test 6. Assignments
K4	Analyze	<ol style="list-style-type: none"> 1. Lab Experiment 2. Case Studies 3. Simulations
K5	Evaluate	<ol style="list-style-type: none"> 1. Case Studies 2. Tutorial Classes 3. Debate 4. Interviews with experts 5. Laboratory Work
K6	Create	<ol style="list-style-type: none"> 1. Mini Projects 2. Final year Projects

E. 2 Attainment of COs

The assessment of COs is important to assess whether the student or learner has attained what is expected out of them. The assessment results are used for continuous quality improvement. The results of course outcomes attainment are used to evaluate the attainment of POs. It is

also used to improve the teaching and learning experience in a particular course. Table E.1 shows the list of assessment tools and their relevance with respect to the blooms knowledge level. The course instructor has a liberty to choose the relevant and appropriate assessment tool. The evaluation of the attainment of course outcomes are carried out by recording the data of the individual marks secured by all the students from continuous assessment tests, assignments, laboratory examinations, project reports, etc.,. Figure 5.1 shows how CO attainments are calculate from internal assessments and end semester examinations. Table 5.2 shows the different weightages given for assessment of each COs through internal examination. Since we are in Tier-II, we depend on the affiliating university and we could not able to record the data of the individual marks secured by all the students in university examination. Hence as per the NBA guidelines, the attainment of the Course is considered to be the attainment of all the COs of that course.

Table E.2 – weightages given for different assessment tools (internal only)

Assessment Method	Course				
	Course Outcome I	Course Outcome II	Course Outcome III	Course Outcome IV	Course Outcome V
Continuous Assessment Tests	60 %	60%	40%	30%	-
Seminar	10%	10%	20%	30%	10 %
Assignments	30%	40%	40%	-	-
Lab Exam	-	-	-	40%	40%
Project Report	-	-	-	-	50%

E.3 Excel Sheet creation for the calculation of attainment of CO's and PO's in KCET

An Excel sheet is created for evaluating the Course Outcome attainment and Program Outcome attainment by giving proper input parameters of student data, CO-PO mapping, assessment tools and weightage, targets, assessment marks. The sheet finally gives the output of how much the CO was attained and also the PO for a single course. Also it delivers the gap between PO expected and PO attained. Hence, this excel sheet is an easy computational tool for CO-PO attainment for all novice users.

The excel sheet is designed in such a way that the cell which contains green fill, at that cell the user must give appropriate input. The following are the input parameters that are needed in the automated excel sheets which is listed as follows.

1. Course code/ Name
2. Name of the Course instructor
3. Academic year
4. Course outcome statements
5. CO – PO expected Mapping in 3 scale (H – high, M – Medium, L –low)
6. List of assessment tools with Weightage for each CO.
7. Target for the course
8. Individual marks secured by the students in internal examination and also in other assessment tools. (both CO wise and Question wise).
9. Individual marks secured by the students in end semester examination.

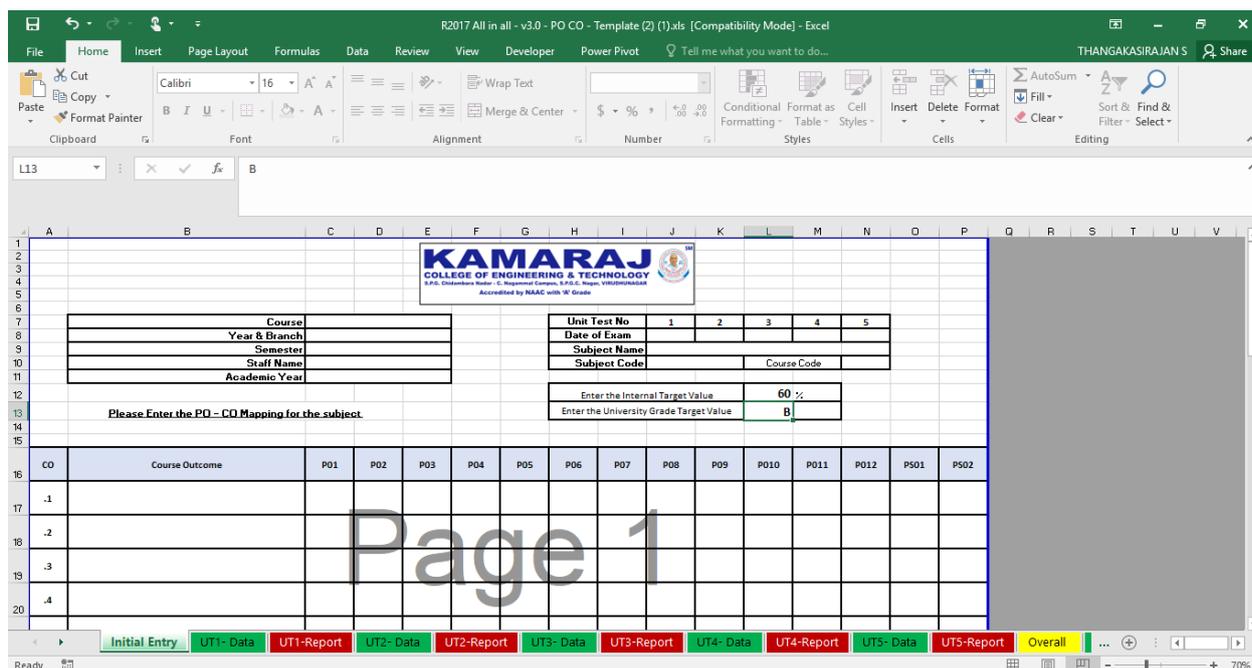


Figure E.2. First Sheet of the CO-PO Attainment Calculation Excel Sheet

CO No	Course Outcome	Assessment Tools				Knowledge Level	Assesment Tools (Weightages in %)				Verified
		1	2	3	4		1	2	3	4	
.1	0	Unit Test 1	Assignment 1				75	25			100
.2	0	Unit Test 2	Assignment 2				75	25			100
.3	0	Unit Test 3	Assignment 3				75	25			100
.4	0	Unit Test 4	Assignment 4				75	25			100
.5	0	Unit Test 5	Assignment 5	Quiz			75	15	10		100

Figure E.3 Inputs for the Course Outcome assessment tool and its weightage

E. 4 Assessment Procedure for Cycle Test / Unit Test Assessment:

Table E.3. Data collection for the assessment of cycle/unit test analysis based on question wise data

S.No	Registration No	Roll No	Name	PART A	PART B	PART C	TOTAL	CO Allotted	CO Attained
				Q1 to Q5	Q6 & Q7	Q8	100		
			CO NO						
			Marks Allotted						
1	XXXXXXXX	XXXXX	Student 1						
2	XXXXXXXX	XXXXX	Student 2						
3	XXXXXXXX	XXXXX	Student 3						
4	XXXXXXXX	XXXXX	Student 4						

For the analysis of cycle test/ unit test the data needed to be collected as mentioned in Table E.3. The CO allotted and CO attained are automatically calculated based on the inputs. Figure E.4 shows the data entry sheet for getting input of student data in unit test. Based on this, the sheet automatically calculates CO allotted, CO attained, Attainment Level, several student analytics based on CO wise, Mark wise and also in question wise etc.

S.No	Registration No	Roll No	Name	Part A - 2 Marks					Part B - 13 Mark								Part C - 14 Mark				Total (50)	Total (100)		
				Q1	Q2	Q3	Q4	Q5	6 a) i	6 a) ii	6 b) i	6 b) ii	7 a) i	7 a) ii	7 b) i	7 b) ii	8 a) i	8 a) ii	8 b) i	8 b) ii				
				CO2	CO2	CO2	CO2	CO2	CO2	NA	CO2	NA	CO2	NA	CO2	NA	CO2	NA	CO2	NA				
1	920416114043	16UMEC003	MAHESH RAMAN G	2	1					12					4				12				31	62
2	920416114061	16UMEC004	NANDHANKUMAAR.R.V	0	1		0			11					1				12				25	50
3	920416114078	16UMEC007	RISHI.R									9			10				11				30	60
4	920416114096	16UMEC011	SURYA PRAKASH.S	0	2					13					5				12				32	64
5	920416114020	16UMEC013	DINESH RAJA.A.M	2	2								13		13				10		0	14	40	80
6	920416114068	16UMEC015	NITHIN.V							6									6				12	24
7	920416114101	16UMEC016	VEANGATAKRISHNA.A	2	2	1	0	1	13						8				10				37	74
8	920416114089	16UMEC017	SHRI KRISHNA.A.K.C.S							13					6				11				30	60
9	920416114053	16UMEC018	MUGESHKANNAN.P	1	2	2				12					10				6				33	66
10	920416114023	16UMEC024	GRIDHARAN.G.M																				AB	AB
11	920416114026	16UMEC029	GOMATHI SUNDAR.S	1	1			0					13		6				10				31	62
12	920416114031	16UMEC030	JAYARAMAKRISHNAN.N	0	1			1					10		11				6				29	58
13	920416114009	16UMEC031	BALAJI.G										13		11				6				30	60
14	920416114045	16UMEC032	MANI.M	2	1	2	0	1					13		10				13				42	84
15	920416114073	16UMEC033	PRABHUDURALA	2	2	2		0		13					10				13				42	84

Figure E.4. Data entry sheet for cycle test/ Unit Test in the excel sheet.

Unit Test 2		Result Analysis																
Subject Name	Finite Element Analysis																	
Subject Code	ME 6603																	
Year and Branch	III-Year - Mech 'A'																	
Subject Handled by	Mr.R.Sakthivel Murugan																	
Unit Test Analysis		Pass Percentage (Based on Strength)																
Total No of Students	65	Pass Percentage (Based on Students Attended)	78.46 %															
No of Students Pass	51																	
No of Students Fail	11																	
No of Students Absent	3																	
Total Attended	62																	
Maximum Mark	90																	
Average Mark	54.23																	
		Mark based Analysis																
		No. of students above 90	0															
		No. of students 80-89	4															
		No. of students 70-79	10															
		No. of students 60-69	13															
		No. of students 50-59	24															
		No. of students 40-49	0															
		No. of students 30-39	4															
		No. of students 20-29	3															
		No. of students 10-19	2															
		No. of students 0-9	2															
Questionwise Analysis		Part A - 2 Marks				Part B - 13 Marks												
		Q1	Q2	Q3	Q4	Q5	6 a) i	6 a) ii	6 b) i	6 b) ii	7 a) i	7 a) ii	7 b) i	7 b) ii	8 a) i	8 a) ii	8 b) i	8 b) ii
No of questions attended by the Students		42	35	25	21	22	35	NA	25	NA	58	NA	2	NA	52	NA	6	NA
No of questions not attended by the Students		20	27	37	41	40	27	NA	37	NA	4	NA	60	NA	10	NA	56	NA
Total Marks Secured for the questions		49	40	16	8	16	356	0	269	0	429	0	7	0	466	0	25	0

Figure E.5. Result Analysis for cycle test/ Unit Test in the excel sheet.



Figure E.4. Data analytics for the cycle test/ Unit Test in the excel sheet.

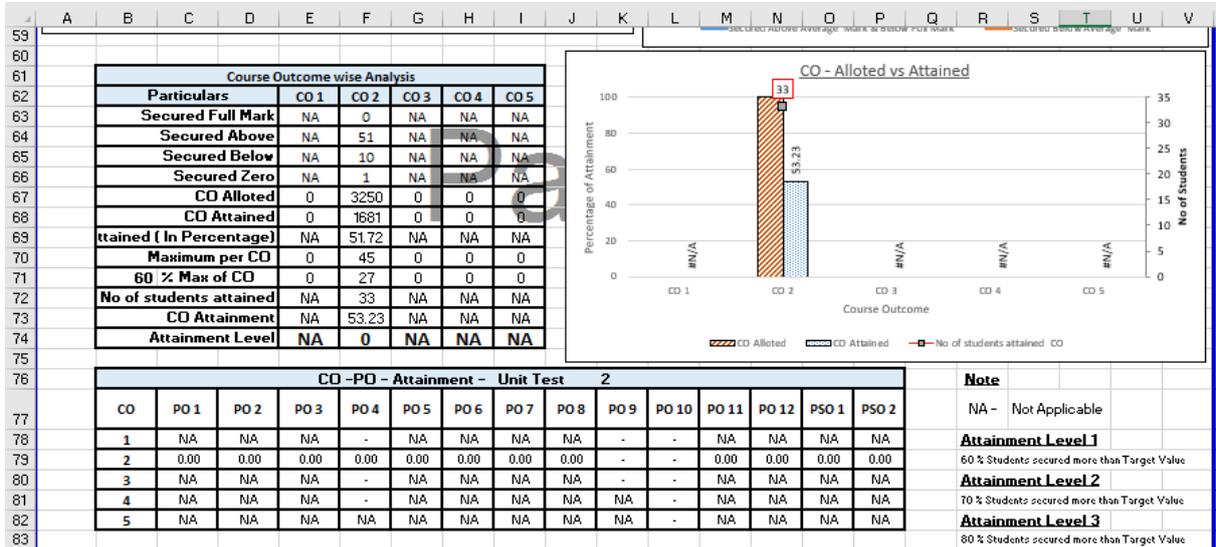


Figure E.5. CO attainment and its PO attainment for cycle test/ Unit Test.

E.5 Procedure to calculate Attainment Level and its CO-PO mapping through excel sheet for cycle test/unit test.

The procedure follows the simple steps as mentioned in table 5.4 and the attainment level was decided as per figure 5.1.

Let's the Target Value = 60% of Max Mark

Table E.4. Input parameters for calculating attainment Level

60	% Max of CO	Target Mark
No of students attained CO		Student Count (a)
CO Attainment Percentage		(a) / Total Students attended
Attainment Level		Bases on Attainment Process

$$\text{CO vs PO Attainment} = \frac{\text{Attainment Level} \times \text{Expected Level}}{3}$$

For Example: For Unit Test 5

60% of Maximum mark	=	24
No of students attained CO	=	53
Total No of Students	=	65
Percentage of CO Attainment	=	85.43 % (53/65)
So., The Attainment Level	=	3 (Since it is under Attainment Level Set '3')
If Attainment Level 3 for the Unit Test 5 (i.e CO5) Which is having weightage as 75 % The CO5 is mapped with PO3 as 'M' then [H=3, M=2 & L=1]		
CO5 vs PO3	=	$2 = \{(3 \times 2) / 3\}$
CO5 vs PO3 (based on weightage)	=	$1.5 = 2 \times 0.75$

E.6 Procedure to calculate Attainment Level and its CO-PO mapping through excel sheet for any assessment tool.

Any assessment tool can be used to evaluate the attainment of CO and it is decided by the individual course instructor. The data to be collected as mentioned in table E.5. The procedure is similar as mentioned in the previous section E.5 and it is explained here with an example.

Table 5.5. Input data of marks from students for the assessment tool.

S.NO	Reg No	Roll No	Name	Assessment Tool (Marks out of 100)
1	XXXXXXXXXX	XXXXXX	Student 1	
2	XXXXXXXXXX	XXXXXX	Student 2	
3	XXXXXXXXXX	XXXXXX	Student 3	
4	XXXXXXXXXX	XXXXXX	Student 4	

Target Value = 60% of Max Mark

Table E.6. Input parameters for calculating attainment Level

60	% Max of CO	Target Mark
No of students attained CO		Student Count (a)
CO Attainment Percentage		(a) / Total Students attended
Attainment Level		Bases on Attainment Process

$$\text{CO vs PO Attainment} = \frac{\text{Attainment Level} \times \text{Expected Level}}{3}$$

For Example:

The Assessment Tool 1 for CO 1 is Assignment.
 Which is having weightage as 25%, then

60% of Maximum mark	=	55.2
No of students attained CO	=	58 (Who have secured more than 55.2)
Total No of Students	=	65
Percentage of CO Attainment	=	89.23 % (58/65)
So., The Attainment Level	=	3 (Since it is under Attainment Level Set '3')
If Attainment Level = 3 for the CO1- Assessment Tool 1 (i.e CO5) Which is having weightage as 25 % The CO1 is mapped with PO4 as 'M' then [H=3, M=2 & L=1]		
CO1 vs PO4	=	$2 = \{(3 \times 2) / 3\}$
CO1 vs PO4 (based on weightage)	=	0.5 = 2 x 0.25

Similarly, the CO vs PO attainment to be calculated for the all 5 CO's with its 12 PO's and 2 PSO's. The result is collected in the tabulated form in the format as mentioned in Table E.7. The Table E.7 is used to evaluate whether the respective CO for a course attained the target or not. If the target is not attained then remedial action to be taken for the same course in next semester.

Table E.7. CO attainment calculation for the internal assessment

CO No	Course Outcomes	Assessment Tools	Weightage (in %)	PO Contribution				CO Attainment Level	Target Attained (YES/NO)
				PO 1	PO 2	...	PO12		
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	Unit Test 1	75						
		Assignment 1	25						
		CO 1 - Attainment							
301.2	Students will able to create a solid modelling by any technique.	Unit Test 2	75						
		Assignment 2	25						
		CO 2 - Attainment							
301.3	Students will able to apply the various visual realism algorithms in CAD.	Unit Test 3	75						
		Assignment 3	25						
		CO 3 - Attainment							
301.4	Students will able to design and evaluate assembly models.	Unit Test 4	75						
		Assignment 4	25						
		CO 4 - Attainment							
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	Unit Test 5	75						
		Assignment 5	15						
		Quiz	10						
		CO 5 - Attainment							

E.7 Excel Sheet Output for internal assessment

CO No	Course Outcomes	Assessment Tools	Weightage (%)	Contribution to Programme Outcomes & Program Specific Outcome												Score of Attain	Pass mark Level	Get Attain 60		
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12				PSO1	PSO2
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	Unit Test 1	15	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	-	0.00	0.00	-	0.59	19.79	NO
		Assignment 1	25	0.75	0.75	0.75	0.50	-	-	-	-	0.50	0.50	-	0.75	0.25	-			
		CO 1 - Attainment		0.75	0.75	0.75	0.50	-	-	-	-	0.50	0.50	-	0.75	0.25	-			
301.2	Students will able to create a solid modelling by any technique.	Unit Test 2	15	0.00	0.00	0.00	0.00	0.00	-	-	-	0.00	0.00	-	0.00	0.00	0.00	0.58	19.17	NO
		Assignment 2	25	0.25	0.50	0.75	0.50	0.75	-	-	-	0.50	0.50	-	0.75	0.50	0.75			
		CO 2 - Attainment		0.25	0.50	0.75	0.50	0.75	-	-	-	0.50	0.50	-	0.75	0.50	0.75			
301.3	Students will able to apply the various visual realism algorithms in CAD.	Unit Test 3	15	0.00	0.00	0.00	0.00	0.00	-	-	-	0.00	0.00	-	0.00	0.00	0.00	0.50	16.67	NO
		Assignment 3	25	0.50	0.50	0.25	0.25	0.75	-	-	-	0.25	0.50	-	0.75	0.50	0.75			
		CO 3 - Attainment		0.50	0.50	0.25	0.25	0.75	-	-	-	0.25	0.50	-	0.75	0.50	0.75			
301.4	Students will able to design and evaluate assembly models.	Unit Test 4	15	0.15	0.15	0.15	0.15	0.15	-	-	-	0.30	0.15	0.30	0.15	0.15	0.15	1.41	46.97	NO
		Assignment 4	25	0.75	0.75	0.75	0.75	0.75	-	-	-	0.50	0.75	0.50	0.75	0.75	0.75			
		CO 4 - Attainment		1.50	1.50	1.50	1.50	1.50	-	-	-	1.00	1.50	1.00	1.50	1.50	1.50			
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	Unit Test 5	15	2.25	2.25	1.50	2.25	2.25	-	-	-	0.75	2.25	1.50	2.25	-	1.50	2.50	83.33	YES
		Assignment 5	15	0.45	0.45	0.30	0.45	0.45	-	-	-	0.15	0.45	0.30	0.45	-	0.30			
		Quiz	10	0.30	0.30	0.20	0.30	0.30	-	-	-	0.10	0.30	0.20	0.30	-	0.20			
		CO 5 - Attainment		3.00	3.00	2.00	3.00	3.00	-	-	-	1.00	3.00	2.00	3.00	-	2.00			

Figure E.5. Automated CO attainment calculation for the internal assessment in the excel sheet

CO No	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	0.75	0.75	0.75	0.50	-	-	-	-	0.50	0.50	-	0.75	0.25	-
301.2	Students will able to create a solid modelling by any technique.	0.25	0.50	0.75	0.50	0.75	-	-	-	0.50	0.50	-	0.75	0.50	0.75
301.3	Students will able to apply the various visual realism algorithms in CAD.	0.50	0.50	0.25	0.25	0.75	-	-	-	0.25	0.50	-	0.75	0.50	0.75
301.4	Students will able to design and evaluate assembly models.	1.50	1.50	1.50	1.50	1.50	-	-	-	1.00	1.50	1.00	1.50	1.50	1.50
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	3.00	3.00	2.00	3.00	3.00	-	-	-	1.00	3.00	2.00	3.00	-	2.00
	CO Attainment (Internal Assesment)	1.20	1.25	1.05	1.15	1.50	-	-	-	0.65	1.20	1.50	1.35	0.69	1.25

Figure E.6. Summary of CO attainment for the respective CO for the internal assessment

E.8 CO Attainment for Anna University Examination:

In Anna University End semester examination, the paper is not evaluated by our faculty members. So, question wise CO PO analysis was not possible to make. Hence for the CO-PO attainment for the end semester exam, the attainment was not calculated in micro level. For this, the student's data is needed which is to be collected as mentioned in Table E.8. For each course, a target value is assigned based on the past 5-year results. The procedure to calculate the attainment level is explained in Table E.9.

Table E.8. Data needed for CO attainment for the end semester exam

S. No	Reg No	Roll No	Name	Anna University Result (Grade)
1	XXXXXXXXXX	XXXXXX	Student 1	
2	XXXXXXXXXX	XXXXXX	Student 2	
3	XXXXXXXXXX	XXXXXX	Student 3	
n	XXXXXXXXXX	XXXXXX	Student n	

Target Value = Average Grade from the results of past 5 Years.

Table E.9. Input parameters for calculating End Semester examination attainment Level

Target Value	Grade
No of students attained Target	Student Count (b)
Attainment Percentage	(b) / Total Students attended
Attainment Level	Based on Attainment Process

$$\text{CO vs PO Attainment} = \frac{\text{Attainment Level} \times \text{Expected Level}}{3}$$

For Example:

The Target Value for the respective Course is ‘D’ Grade

Which is having weightage as 80%, then

No of students attained target grade in AU Exam	=	42
Percentage of Attainment	=	64.6 % (42/65)
So., The Attainment Level = 1 (Since it is under Attainment Level Set ‘1’) It should be mapped with respective CO’s and PO’s The CO1 is mapped with PO4 as ‘M’ then [H=3, M=2 & L=1]		
CO1 vs PO4	=	0.666 = {(1x2)/3}
CO1 vs PO4 (based on weightage)	=	0.5 = 2 x 0.25

It is then summarized as

CO No	Course Outcomes	Contribution to Programme Outcomes & Program Specific Outcome													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	1.00	1.00	1.00	0.67	-	-	-	-	0.67	0.67	-	1.00	0.33	-
301.2	Students will able to create a solid modelling by any technique.	0.33	0.67	1.00	0.67	1.00	-	-	-	0.67	0.67	-	1.00	0.67	1.00
301.3	Students will able to apply the various visual realism algorithms in CAD.	0.67	0.67	0.33	0.33	1.00	-	-	-	0.33	0.67	-	1.00	0.67	1.00
301.4	Students will able to design and evaluate assembly models.	1.00	1.00	1.00	1.00	1.00	-	-	-	0.67	1.00	0.67	1.00	1.00	1.00
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	1.00	1.00	0.67	1.00	1.00	-	-	-	0.33	1.00	0.67	1.00	-	0.67
CO Attainment (University Results)		0.80	0.87	0.80	0.73	1.00	-	-	-	0.53	0.80	0.67	1.00	0.67	0.92

Figure E.7. Summary of CO attainment for the respective CO for the End Semester Examination

E.9 Course Closure & Beginning Report

The course closure report is a report received from the course instructor which consists of Pedagogical initiatives taken, feedback of the instructor, Course attainment details and other suggestions related to the course regarding the target and revision in CO statements, teaching learning pedagogy to be taken, etc.,

The course instructor has to maintain all the marks then and there during the course and analysis has to be made for better learning process which has to be submitted and verified by Head of the Department adequately. After the end of the course and all results were declared, he/she has to complete with a report called course closure report and the same has to be submitted to the Head of the Department along with course file.

This course closure report is a feedback for the instructor who is going to handle the same course in the upcoming academic years. It is also used for the instructors to plan their instructional design what has to be prepared and delivered to the students. Before the commencement of the course the new instructor needs to prepare the course beginning report. He has to mention the action plan in his/her course file. A sample course closure report & Course beginning report is enclosed for reference.

Course Closure report- sample copy

Subject Name: xxxx Subject Code: xxxxx
 Year and Semester: xxx Branch: xxxxx
 Faculty Name: xxxxxx Year : xxxxx

1. Methodologies adopted for content delivery:
2. Suggestions for improvement:
3. Innovativeness adopted in Teaching Learning process: -
4. CO / PO attainment Level:
5. Have you achieved the target level?
 Course Target Level = Course Attained / Course Expected * 3
 Course Attainment Range:
6. If target not attained, give reasons:
7. Give action plan for future reference:
8. Whether course outcome needs revision?
9. If Yes, mention how?
10. Suggestions to improve Course Material:

Course Beginning Report- Sample copy

Name :xxxx Course Code : xxxx
 Sub Code/Name : xxxx Year :xx
 University Target: xx Internal Target : xxxx
Result Analysis : Course Attainment in : xx

No of Students secured more than the target	No of students secured less than target and Pass in University	No of students Failed
---	--	-----------------------

Feedback in T-L pedagogy (by course instructor handled previously)
 Action Plan of the course instructor to be followed for this semester:

F. Program Outcome (POs and PSOs) Attainment:

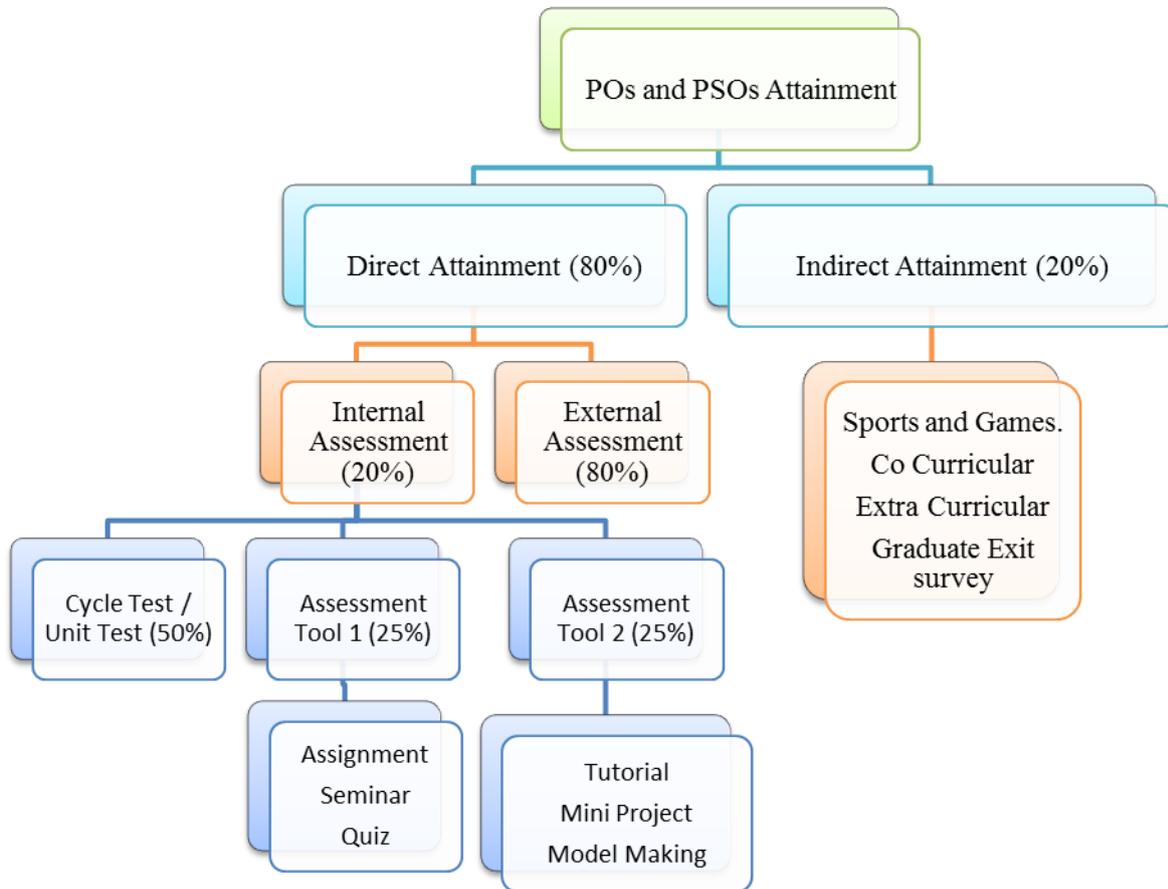


Figure F.1. PO and PSO attainment process and its weightage for the assessment tools

- i. Direct attainment - 80%
- ii. Indirect attainment - 20%

The attainment of CO is explained in section 5. In order to make it a closed loop, the CO attainment should be mapped with all PO's to evaluate the PO's attainment for the single course. Each course gives the output of CO attainment for both University results and Internal assessment as mentioned earlier. As mentioned in Figure F.1, the direct attainment was calculated by CO attainment of 80% End Semester Exam and CO attainment of 20% internal assessment.

For Example:

For PO1, the Anna University End Semester Examination , Attainment Level = 1
 Internal Assessment Tool 1 (Assignment 1) , Attainment Level = 3

$$\begin{aligned} \text{Direct Attainment} &= (\text{AU CO Attainment} \times 0.8) + (\text{Internal Assessment} \times 0.2) \\ &= (1 \times 0.8) + (0.75 \times 0.20) \\ &= 0.8 + 0.15 \\ &= 0.95 \end{aligned}$$

For PO1, the Anna University End Semester Examination , Attainment Level = 1 Internal Assessment Tool 1 (Assignment 1) Attainment Level = 3		
Direct Attainment	=	$(\text{AU CO Attainment} \times 0.8) + (\text{Internal Assessment})$
CO1 vs PO4 (based on weightage)	=	$= 0.95$ $\{(1 \times 0.8) + (0.75 \times 0.20)\}$ $= 0.8 + 0.15$

Similarly, Calculate it for all the COs and PO's.

The results from the previous Table E.6 & E.7 are tabulated as follows, to evaluate the direct attainment of PO's for the respective course. In our excel sheet, the Direct attainment is calculated automatically, and it is shown in Figure F.2.

A	B	C	D	Contribution to Programme Outcomes & Program Specific Outcome													
CO No	Course Outcomes	Assessment Tools	Weightage (in %)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	Anna University	80	0.80	0.80	0.80	0.53	-	-	-	-	0.53	0.53	-	0.80	0.27	-
		Internal Assessment	20	0.15	0.15	0.15	0.10	-	-	-	-	0.10	0.10	-	0.15	0.05	-
		CO 1 - Direct Attainment		0.95	0.95	0.95	0.63	-	-	-	-	0.63	0.63	-	0.95	0.32	-
301.2	Students will able to create a solid modelling by any technique.	Anna University	80	0.27	0.53	0.80	0.53	0.80	-	-	-	0.53	0.53	-	0.80	0.53	0.80
		Internal Assessment	20	0.05	0.10	0.15	0.10	0.15	-	-	-	0.10	0.10	-	0.15	0.10	0.15
		CO 2 - Direct Attainment		0.32	0.63	0.95	0.63	0.95	-	-	-	0.63	0.63	-	0.95	0.63	0.95
301.3	Students will able to apply the various visual realism algorithms in CAD.	Anna University	80	0.53	0.53	0.27	0.27	0.80	-	-	-	0.27	0.53	-	0.80	0.53	0.80
		Internal Assessment	20	0.10	0.10	0.05	0.05	0.15	-	-	-	0.05	0.10	-	0.15	0.10	0.15
		CO 3 - Direct Attainment		0.63	0.63	0.32	0.32	0.95	-	-	-	0.32	0.63	-	0.95	0.63	0.95
301.4	Students will able to design and evaluate assembly models.	Anna University	80	0.80	0.80	0.80	0.80	0.80	-	-	-	0.53	0.80	0.53	0.80	0.80	0.80
		Internal Assessment	20	0.30	0.30	0.30	0.30	0.30	-	-	-	0.20	0.30	0.20	0.30	0.30	0.30
		CO 4 - Direct Attainment		1.10	1.10	1.10	1.10	1.10	-	-	-	0.73	1.10	0.73	1.10	1.10	1.10
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	Anna University	80	0.80	0.80	0.53	0.80	0.80	-	-	-	0.27	0.80	0.53	0.80	-	0.53
		Internal Assessment	20	0.60	0.60	0.40	0.60	0.60	-	-	-	0.20	0.60	0.40	0.60	-	0.40
		CO 5 - Direct Attainment		1.40	1.40	0.93	1.40	1.40	-	-	-	0.47	1.40	0.93	1.40	-	0.93

Figure 7.2 Calculation of Direct Attainment for the single course.

Figure F.2 is then summarized further, to get overall PO attainment for the single course as mentioned in Figure F.3. Some data analytics are done using these outputs to get how much deviations in PO expected vs PO attained which is shown in Figure F.4.

CO No	Course Outcomes	Direct Attainment of PO vs CO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
301.1	Students will able to implement the fundamentals of Computer Graphics in CAD by any programming language.	0.95	0.95	0.95	0.63	-	-	-	-	0.63	0.63	-	0.95	0.32	-
301.2	Students will able to create a solid modelling by any technique.	0.32	0.63	0.95	0.63	0.95	-	-	-	0.63	0.63	-	0.95	0.63	0.95
301.3	Students will able to apply the various visual realism algorithms in CAD.	0.63	0.63	0.32	0.32	0.95	-	-	-	0.32	0.63	-	0.95	0.63	0.95
301.4	Students will able to design and evaluate assembly models.	1.10	1.10	1.10	1.10	1.10	-	-	-	0.73	1.10	0.73	1.10	1.10	1.10
301.5	Students can able to apply the various CAD standards and CAD neutral files in complex models.	1.40	1.40	0.93	1.40	1.40	-	-	-	0.47	1.40	0.93	1.40	-	0.93
301	Computer Aided Design	0.88	0.94	0.85	0.82	1.10	-	-	-	0.56	0.88	0.83	1.07	0.67	0.98

Figure F.3 Summary of Direct Attainment for the single course.

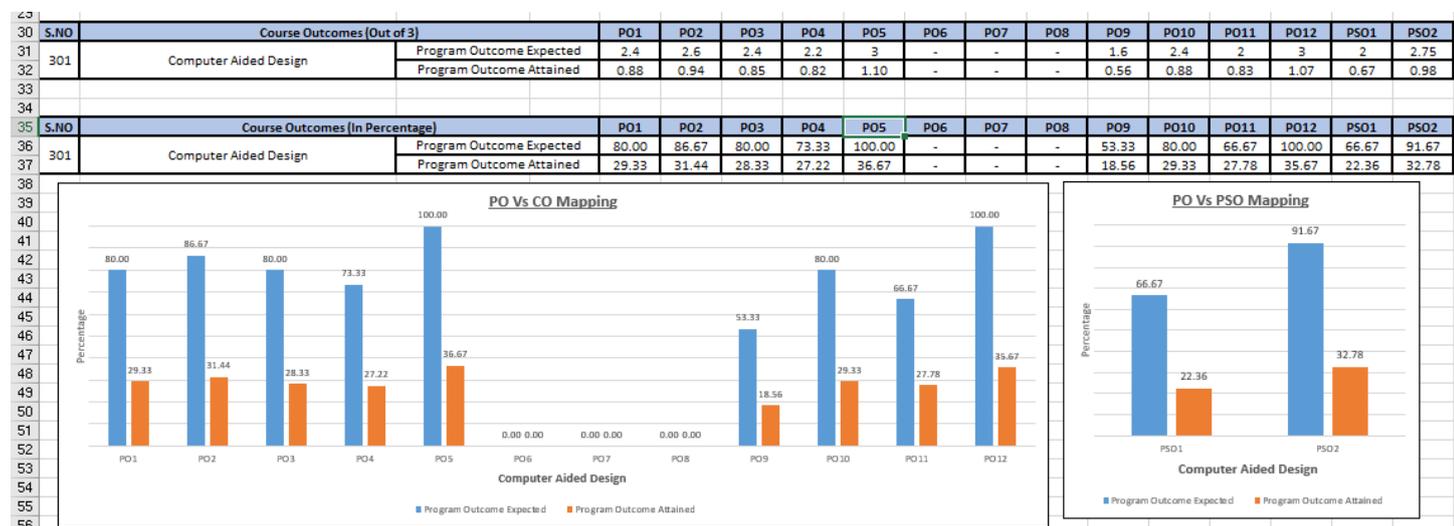


Figure F.4 Data Analytics of PO expected vs PO attained for a single course.

F.1 Average Course Outcome for a course based on PO attainment

The Overall Course Expected and attained is the average of the values obtained from PO1 to PSO2. For the above course,

C301- Computer Aided Design

POs	Expected	Attained
PO1	2.4	0.88
PO2	2.6	0.943
PO3	2.4	0.85
PO4	2.2	0.81
PO5	3	1.1

PO6	-	-
PO7	-	-
PO8	-	-
PO9	1.6	0.55
PO10	2.4	0.88
PO11	2	0.83
PO12	3	1.07
PSO1	2	0.67
PSO2	2.75	0.98
Overall	2.39	0.87

Therefore, the Course attainment for a course named ‘Computer Aided Design’ is 0.87. It is the data exactly needed for the course closure and beginning report for strategic planning and improvement.

F.2 Overall Program Attainment by summarizing all the courses

By summarizing all the courses in the Program for a particular batch of students that they have pursued, will lead to give the output of PO expected and PO attained for the entire Program for a particular batch.

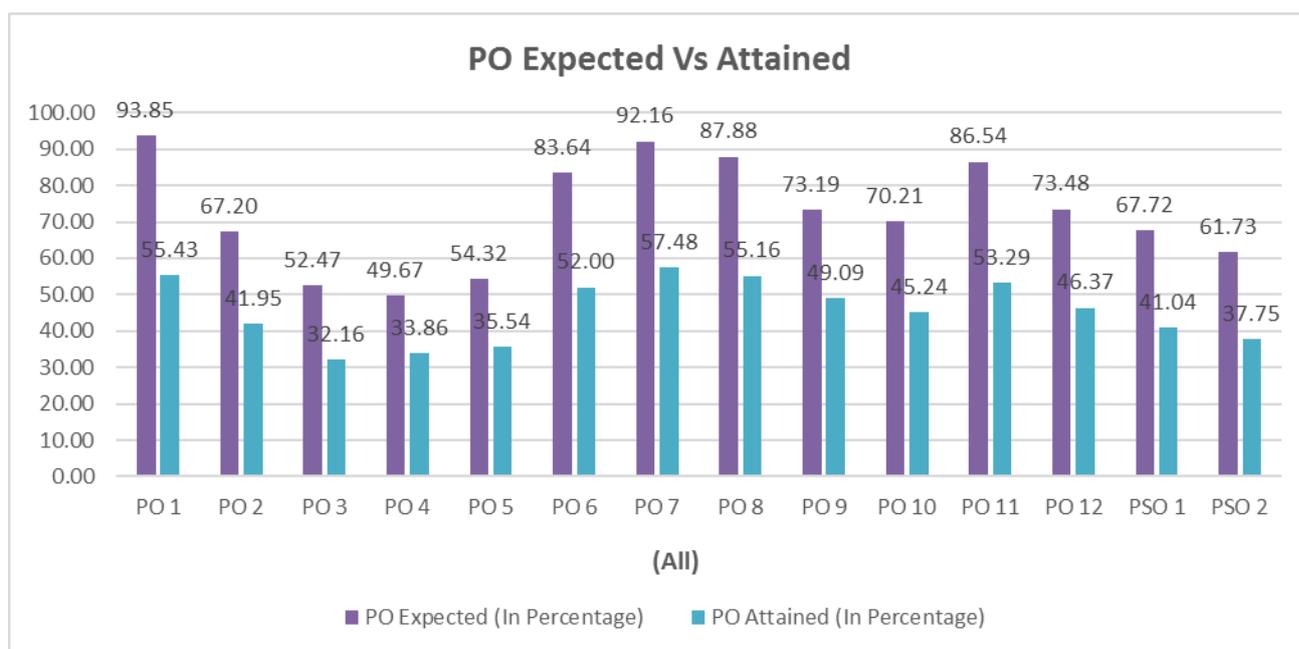
S.No	CO	Subject Code	Course Name	01 [E]	02 [E]	03 [E]	04 [E]	05 [E]	06 [E]	07 [E]	08 [E]	09 [E]	010 [E]	011 [E]	012 [E]	S01 [E]	S02 [E]
	101																
	102																
8	413																
Overall Course Program Outcome Expected																	

Figure F.5 Summary of Program Expected for a specific batch of Students

S.No	CO	Subject Code	Course Name	01 [A]	02 [A]	03 [A]	04 [A]	05 [A]	06 [A]	07 [A]	08 [A]	09 [A]	010 [A]	011 [A]	012 [A]	S01 [A]	S02 [A]
	101																
	102																
8	413																
Overall Course Program Outcome Attained																	

Figure F.6 Summary of Program Attained for a specific batch of Students

F.3 Data Analysis of PO Attainment for the entire Program



F.4 Analysis of the PO by domain wise case study.



Significant features and outcome obtained by the use of excel sheets are given below:

- Course outcome attainment was calculated directly. (20 % internal + 80% end semester Examination)
- Course to PO attainment also calculated and the contribution of Cos with the POs are obtained.
- Student wise data analysis were done using the excel sheets.
- Weak areas or unlearnt areas of the students are easily identified based on the results obtained by them.
- The excel sheets help us to take decision or action plan and provides us a feedback which is an indicator for further plan and improvement in teaching and Learning process.
- It also supports the entire teaching faculty for doing data analysis by minimizing time and helps us to get quick conclusions.

Outcome obtained by the use of excel sheets	
Version	Focuses on
1	Only one cycle test CO PO Analysis can be calculated
2	All the three cycle test results brought into CO PO Analysis calculation. All the assessment tools and End semester results are included. Different weightage can also be appropriately introduced
3	Cycle test / Unit test Assessment tools, End semester CO Attainment, PO Attainment, Separate sheet for R2013 and R2017 included
4	Flexibility on calculation of CO PO attainment for R2013 & R2017, Knowledge level attainment and individual student wise CO PO analysis can be analysed.

G. Continuous improvement:

For the continuous improvement in POs and PSOs attainment, the following action plans are followed for hot and soft POs

Strengthening of PO's & PSO's attainment	Action taken
Hot POs	
PO1: Engineering Knowledge	Innovative Teaching Learning Process, Value added course, content beyond syllabus, Guest lecture, Assignment, Mini Project, Industrial visit -Activity based learning
PO2: Problem Analysis	
PO3: Design/Development of Solutions	
PO4: Conduct complex investigation	Project
PO5: Modern Tool Usage	Industrial visit, Project
Soft POs	
PO6: Engineer and Society	Membership in Professional society
PO7: Environmental and sustainable ability	Mini project, Member in Club activities
PO8: Ethics	Industrial visit, Alumni interaction Laboratory ethics, Interaction with outside world
PO9: Individual and team work	Seminar, Group activity, Project Team –lab and project
PO10: Communication	
PO11: Project management and finance	Project – Cost estimation
PO12: Lifelong Learning	Online courses, Assignment NPTEL Course, webinar

Appendix

1. Demonstration of Course outcome attainment –Model Calculation
2. Demonstration of Program outcome attainment – (Direct and Indirect attainment) --Model Calculation

1. Demonstration of CO1 attainment - MODEL CALCULATION

Step1: UNIT TEST QUESTION

DEPARTMENT OF XXXXXXXX

I-UNIT TEST

Total Marks : XX

Time : XX

Year : XXXX

Staff Name : XXXX

Subject Code and Name : XXXXXX

Date :

Course Outcomes:

C311.1: Students will able to acquire knowledge on the national and international standards and techniques of test specimen preparation

CO (Course code as per NBA): C311

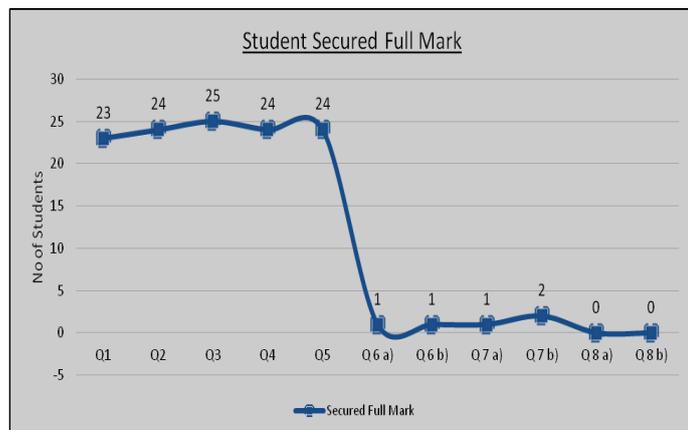
Q. No:	Question	Blooms taxonomy Level	CO Mapping
Part A (5 x 2 = 10 Marks)			
1	Define standard.	K1	C311.1
2	List any two importance of conditioning the test specimen?	K1	C311.1
3	How is particle size analyzed?	K2	C311.1
4	What is the purpose of specification? Give one example	K1	C311.1
5	How is specific gravity of plastics analyzed?	K2	C311.1
Part B (2 x 13 = 26 marks)			
6 (a)	Explain the preparation of test specimen for thermoplastic, thermoset and elastomers (4+4+5 Marks)	K2	C311.1
(or)			
6 (b)	Discuss the following analytical test 1. Specific gravity, 2. Particle size analyser and 3. Bulk density (4+4+5 Marks)	K2	C311.1
7 (a)	Explain the specification in plastic testing with suitable example and write its importance. (8+5 Marks)	K2	C311.1
(or)			
7(b)	Explain how conditioning is applied for polymer samples, with examples and write the reasons for conditioning the test specimen (8+5 Marks)	K2	C311.1
Part C (1 x 14 = 14 Marks)			
8 (a)	Select the appropriate national and international standard for the following statement and explain the standards? (5+5+4 Marks) 1. Tensile testing 2. Quality standard 3. PP material for moulding and extrusion	K3	C311.1
(or)			
8(b)	Select any two appropriate methods, which is used to accurately measure the moisture content and Explain the procedure and mention the effects of moisture present in the nylon samples(5+5+4 Marks)	K3	C311.1

Step2: STUDENT UNIT TEST MARK

S. no	Name	Part A - 2 Marks					Part B - 13 Mark								Part C - 14 Mark				Total (50)	No of students attained CO1 (above28)
		Q1	Q2	Q3	Q4	Q5	6 a) i	6 a) ii	6 b) i	6 b) ii	7 a) i	7 a) ii	7 b) i	7 b) ii	8 a) i	8 a) ii	8 b) i	8 b) ii		
Course Outcome NO		CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1		
Marks Allotted		2	2	2	2	2	13	0	13	0	13	0	13	0	14		14			
1	XXX	2	1	2	0	2	10						10				9		36	1
2	XXX	1	1	1	1	1	8					8					3		24	
3		1	1	1	1	1	7					7					5		24	
4		2	2	2	2	2	13						13				12		48	2
5		2	1	2	2	1	11					10			8				37	3
6		2	2	2	2	2	8						8		11				37	4
7		1	2	2	1	2	11					10			11				40	5
8		1	1	1	0	2	11						10		9				35	6
9		2	2	2	1	2	12					13			13				47	7
10		2	2	2	2	2			12				12		12				46	8
11		2	2	2	2	2	12						12		12				46	9
12		2	2	2	2	2	11					11					12		44	10
13		2	2	2	2	2	11						9		9				39	11
14		2	1	2	2	2	11						7				8		35	12
15		2	2	2	2	2			11		10						12		43	13
16		2	2	2	2	2			11		3						11		35	14
17		2	2	2	2	2	12						12				10		44	15
18		2	2	2	2	2	12						13				13		48	16
19		2	2	2	2	2	11					10			12				43	17
20		2	2	2	2	2			13				12				13		48	18
21		2	2	2	2	1			11				6			9	10		36	19
22		1	2	2	2	1		9				6	6		6				35	20
23		2	2	2	2	2			12				12				13		47	21
24		2	2	0	2	2	10					11			11				40	22
25		2	2	2	2	2	9						7		10				36	23
26		2	2	2	2	2	9						6		11				36	24
27		2	2	1	2	2	10						7				9		35	25
28																			AB	
29		2	2	2	2	2	8						10		11				39	26
30		1	2	2	2	1	10						8				9		35	27
31		1	2	2	2	2	10						7				9		35	28
TOTAL MARKS (CO1 ATTAINED)																			1173	

STEP 3 : CO ATTAINMENT

CO ATTAINMENT	
CO1 Allotted (31 students * 50 Max. Mark)	1550
CO1 Attained (Adding the 31 students Marks)	1173
Maximum per CO1 (Student got highest mark)	48
TARGET - 60 % Max of CO1	28.8
No of students attained CO1 (No. of students got above 28.8)	28
CO1 Attainment Percentage (28/31*100)	90.33
Attainment Level	3



Attainment (Target) Level	Percentage of students
1	60 % of students secure above 60 % of maximum mark
2	70 % of students secure above 60 % of maximum mark
3	80 % of students secure above 60 % of maximum mark

STEP 4 : CO –PO ATTAINMENT (Contribution of CO1 to PO's & PSO's – Attainment)

CO1 – PO's & PSO's - Attainment- in Unit test 1														
CO1	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
Mapping (standard and specification)	H	L	M		M	L	L	M	-	L	M	H	H	H
Matrix	3	1	2		2	1	1	2		1	2	3	3	3
attainment	3/3*3	1/3*3	2/3*3		2/3*3	1/3*3	1/3*3	2/3*3		1/3*3	2/3*3	3/3*3	3/3*3	3/3*3
CO1 Attainment in unit test	3.00	1.00	2.00	0.00	2.00	1.00	1.00	2.00	-	1.00	2.00	3.00	3.00	3.00

2. Demonstration of Direct Attainment - MODEL CALCULATION

STEP 4 : CO –PO ATTAINMENT (Contribution of CO1 to PO's & PSO's – Attainment)

CO1 – PO's & PSO's - Attainment- in Unit test 1														
CO1	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
Mapping (standard and specification)	H	L	M		M	L	L	M	-	L	M	H	H	H
Matrix	3	1	2		2	1	1	2		1	2	3	3	3
attainment	3/3*3	1/3*3	2/3*3		2/3*3	1/3*3	1/3*3	2/3*3		1/3*3	2/3*3	3/3*3	3/3*3	3/3*3
CO1 Attainment in unit test	3.00	1.00	2.00	0.00	2.00	1.00	1.00	2.00	-	1.00	2.00	3.00	3.00	3.00

STEP 5: Calculate CO –PO ATTAINMENT for All assessment tools = 5 UNIT TEST, 5 ASSIGNMENT AND UNIVERSITY EXAM

Step 6 : C311 course contribution in Direct attainment of PO vs CO

Direct Attainment of PO vs CO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2.20	0.73	1.47	0.00	1.47	0.73	0.73	1.47	0.00	0.73	1.47	2.20	2.20	2.20
CO2	2.20	1.47	1.47	0.00	1.47	0.73	0.00	0.73	0.00	1.47	1.47	2.20	2.20	2.20
CO3	2.20	1.47	1.47	0.00	1.47	0.73	0.00	0.73	0.00	1.47	1.47	2.20	2.20	2.20
CO4	2.20	1.47	1.47	0.00	1.47	0.73	0.00	0.73	0.00	1.47	1.47	2.20	2.20	2.20
CO5	2.20	0.00	1.47	0.00	1.47	0.73	0.73	0.73	0.00	0.73	1.47	2.20	2.20	2.20
PO ATTAINED IN C311	2.20	1.03	1.47	0.00	1.47	0.73	0.29	0.88	0.00	1.17	1.47	2.20	2.20	2.20

Step 7: DIRECT ATTAINMENT (80% weightage)

PO Attainment through CO attained value

PO attainment value for each course 2014-2018 batch														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C101										0.67			0.33	0.33
C102	1.00	0.67	0.33										1.00	1.00
C103	2.00	1.60	1.73	1.07	1.20	0.67	0.67				0.67	1.33	1.17	0.67
C104	0.00	0.00						0.00			0.00		0.00	0.00
C105	0.00	0.00	0.00	0.00		0.00	0.00	0.00			0.00	0.00	0.00	0.00
C106	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C107	1.00	2.00						1.00		2.00			1.00	1.00
C108	3.00	2.00	1.00										1.00	1.00
C109	0.00	0.00						0.00			0.00		0.00	0.00
C110										0.67			0.33	0.33
C111	0.00	0.00	0.00									0.00	0.00	0.00
C112	0.87	0.53	0.33										0.40	0.33
C113	2.00	1.67	2.00		1.20	1.33	1.50					1.87	2.00	2.00
C114	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
C115	0.00	0.00	0.00	0.00		0.00	0.00	0.00			0.00	0.00	0.00	0.00
C116	0.00	0.00	0.00									0.00	0.00	0.00
C117	2.00	1.33	0.67	2.00	1.33			1.33			2.00	1.67	1.47	0.67
C118	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
C201	0.00	0.00	0.00	0.00							0.00		0.00	0.00
C202	0.00	0.00					0.00	0.00		0.00		0.00	0.00	0.00
C203	1.33	1.11		0.67	0.67					0.67	0.67	0.67	1.33	1.33
C204	0.00		0.00			0.00	0.00			0.00	0.00	0.00	0.00	0.00
C205	0.00	0.00	0.00		0.00				0.00	0.00		0.00	0.00	0.00
C206	0.00	0.00			0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00
C207	3.00		2.00		1.00		1.00	2.00	3.00	2.00	1.00	2.00	2.00	2.00
C208	3.00		2.00			2.00	1.00	2.00	3.00	2.00		1.00	1.00	1.00
C209	0.21	0.17	0.09	0.09									0.15	0.07
C210	1.30		1.30		0.65								1.32	1.32
C211	0.45	0.30	0.15	0.15	0.35	0.15	0.15	0.15	0.27	0.30	0.21	0.30	0.30	0.42
C212	1.90	0.51	0.50		0.26	0.12	0.25			0.13			1.90	1.90
C213	0.44	0.44	0.29	0.27	0.24	0.35	0.23					0.39	0.44	0.44
C214	0.35	0.23	0.12	0.12			0.35					0.23	0.35	0.23
C215	3.00	2.00	2.00	2.00	2.00	1.00	1.00			1.00			3.00	3.00
C216	0.93		0.93		0.93		0.93	0.93					0.93	0.93
C301	0.99	0.77	0.42	0.42									0.71	0.35
C302	0.37	0.25	0.05	0.02	0.02								0.37	0.37

C303	0.18	0.18	0.15	0.12	0.12	0.15	0.10		0.09		0.10	0.18	0.18	0.18
C304	0.31	0.21	0.31	0.10	0.21	0.15	0.10	0.10	0.18	0.24	0.31	0.15	0.31	0.25
C305	0.18	0.18	0.18	0.16	0.12	0.12	0.10	0.04				0.18	0.18	0.18
C306	0.93	0.39	0.52	0.15	0.41	0.24	0.14				1.00	1.00	1.00	1.00
C307								2.00	3.00	3.00		1.00	2.00	2.00
C308	2.20	1.47	2.20		1.47	0.73	1.47	1.47	1.47	-	-	2.20	2.20	2.20
C309	0.27	0.17	0.14	0.02	0.10					0.18	0.09	0.18	0.27	0.27
C310	1.08	0.29	0.30	0.13	0.13	0.08	0.7			0.07			1.08	1.08
C311	2.20	1.03	1.47	0.00	1.47	0.73	0.29	0.88	0.00	1.17	1.47	2.20	2.20	2.20
C312	0.73	0.07			0.36	0.07				0.44	0.07	0.07	0.36	0.36
C313	1.12	0.75	0.07		0.16		0.06						1.12	1.12
C314	0.19		0.06		0.13		0.01					0.13	0.19	0.19
C320	0.13	0.09	0.04				0.09					0.09	0.13	0.09
C315	0.60	0.40	0.40	0.20	0.20	0.20	0.40	0.20	0.40	0.40	0.20	0.60	0.60	0.60
C316	0.60	0.40	0.60	-	0.20	-	0.20	0.40	0.40	0.20	-	0.60	0.60	0.60
C401	1.06	0.50	0.85	0.22	0.14				0.35	0.35	0.71	1.06	1.06	1.06
C402	0.09	0.01	0.06		0.05	0.04	0.01	0.09	0.03	0.09	0.03	0.04	0.09	0.04
C403	0.25	0.17	0.15		0.05	0.09	0.11			0.17	0.08	0.17	0.25	0.25
C404	0.37	0.00	0.00	0.00	0.25								0.37	0.37
C405	1.85	1.23	0.62	0.62			1.85					1.23	1.85	1.23
C410	0.21	0.05		0.04		0.12			0.04	0.11	0.16	0.20	0.21	0.07
C416	1.81	1.29	0.91							0.91	0.91	0.91	1.81	1.81
C406	0.40	0.40	0.20	0.20	0.40			0.20	0.40	0.20	0.20	0.40	0.40	0.20
C407	2.20	0.73			1.47	0.73	0.88	1.47	1.47	1.47	1.47	1.47	2.20	2.20
C408									1.00	1.00		1.00	1.00	1.00
C409	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	3.00	2.00	3.00	3.00	3.00	3.00
Overall Direct ATTAINMENT for PO (100 %)	0.85	0.53	0.56	0.41	0.53	0.42	0.44	0.70	0.90	0.63	0.44	0.61	0.73	0.68

Overall Direct ATTAINMENT for PO (80 % weightage)	0.68	0.43	0.45	0.33	0.42	0.34	0.35	0.56	0.72	0.51	0.35	0.49	0.58	0.55
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Step 2 : Input - Calculating the average value for Q.No 6 & Q.No 9 from alumni feedback question

S.NO	Q. No. 6	Q. No. 9
1	1	1
2	2	1
3	1	1
4	2	2
5	3	3
6	1	1
7	2	2
8	2	2
9	3	3
10	3	2
11	3	2
12	2	3
13	2	2
14	2	2
15	3	3
16	2	3
17	2	2
18	2	2
19	3	2
20	2	2
21	3	3
22	2	3
Average	2.18	2.14

Step 3 : Calculating the PO attainment in Alumni Feed back (15 % weightage)

QUESTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
(Q.No. 6) Identification of knowledge and skills required to excel in your career.	M	M	M	L	M	-	-	-	-	-	L	L	M	M
Matrix	2	2	2	1	2	-	-	-	-	-	1	1	2	2
PO attainment for (Q.No. 6) (Q.No.6 Average =2.18)	$\frac{2}{3} \times 2.18$ 1.45	$\frac{2}{3} \times 2.18$ 1.45	$\frac{2}{3} \times 2.18$ 1.45	$\frac{1}{3} \times 2.18$ 0.73	$\frac{2}{3} \times 2.18$ 1.45						$\frac{1}{3} \times 2.18$ 0.73	$\frac{1}{3} \times 2.18$ 0.73	$\frac{2}{3} \times 2.18$ 1.45	$\frac{2}{3} \times 2.18$ 1.45
(Q. No. 9) Understanding contemporary ethical and societal issues related to the profession.	-	-	-	-	-	M	M	M	L	L	L	L	M	L
Matrix	-	-	-	-	-	2	2	2	1	1	1	1	2	1
PO attainment for (Q.No. 9) (Q.No.6 Average =2.14)	-	-	-	-	-	$\frac{2}{3} \times 2.14$ 1.43	$\frac{2}{3} \times 2.14$ 1.43	$\frac{2}{3} \times 2.14$ 1.43	$\frac{1}{3} \times 2.14$ 0.71	$\frac{1}{3} \times 2.14$ 0.71	$\frac{1}{3} \times 2.14$ 0.71	$\frac{1}{3} \times 2.14$ 0.71	$\frac{2}{3} \times 2.14$ 1.43	$\frac{1}{3} \times 2.14$ 0.71
PO attainment in alumni feedback = Average of PO	1.45	1.45	1.45	0.73	1.45						0.73	0.73	1.45	1.45
Attainment for Q.No 6 and Q.No 9						1.43	1.43	1.43	0.71	0.71	0.71	0.71	1.43	0.71
PO attainment in alumni feedback (100 %)	1.45	1.45	1.45	0.73	1.45	1.42	1.42	1.42	0.71	0.71	0.72	0.72	1.44	1.08

Value: 3- High (H); 2- Medium (M); 1- Low (L)

PO attainment in alumni feedback (15%)	0.22	0.22	0.22	0.11	0.22	0.21	0.21	0.21	0.11	0.11	0.11	0.11	0.22	0.16
---	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Step 4: OVERALL INDIRECT ATTAINMENT –ATTAINED VALUE CALCULATION

PO attainment in indirect	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PO attainment in alumni feedback (15%)	0.22	0.22	0.22	0.11	0.22	0.21	0.21	0.21	0.11	0.11	0.11	0.11	0.22	0.16
PO attainment in xxxxx (15%)	0.17	0.17	0.14	0.10	0.10	0.10	0.10	0.20	0.29	0.20	0.10	0.20	0.15	0.18
PO attainment in xxxxx(15 %)	0.15	0.18	0.22	0.15	0.22	0.17	0.22	0.15	0.11	0.14	0.14	0.22	0.17	0.20
PO attainment to Project (55 %)	1.10	1.10	1.10	-	0.37	-	-	0.37	0.73	0.73	0.73	-	1.10	-
overall Indirect attainment (100 %)	1.64	1.67	1.67	0.36	0.91	0.48	0.54	0.92	1.24	1.18	1.08	0.53	1.64	0.54
overall Indirect attainment (20 %)	0.33	0.33	0.33	0.07	0.18	0.10	0.11	0.18	0.25	0.24	0.22	0.11	0.33	0.11

Step 5: OVERALL PO'S & PSO'S ATTAINMENT

- through DIRECT ATTAINMENT & INDIRECT ATTAINMENT - Attained Value

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Direct attainment - PO Attained (80 % weightage)	0.68	0.43	0.45	0.33	0.42	0.34	0.35	0.56	0.72	0.51	0.35	0.49	0.58	0.55
PO attainment in Indirect attainment (20 % weightage)	0.33	0.33	0.33	0.07	0.18	0.10	0.11	0.18	0.25	0.24	0.22	0.11	0.33	0.11
Sum	1.01	0.76	0.78	0.4	0.6	0.44	0.46	0.74	0.97	0.75	0.57	0.6	0.91	0.66



(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

DEPARTMENT OF MECHANICAL ENGINEERING

ACCREDITED BY NBA, NEW DELHI

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1	Simulation and Analysis of Lab Manual in OBE Format.	Literary/ Dramatic Work	9925/2017-CO/L	Sakthivel Murugan.R (AP/Mech) Madhan.N. R (AP/Mech)	Registered	L-68793/2017	19/09/2017	

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2	PO-CO Attainment Calculation Sheet for various assessments using MS Excel (Version 1)	Computer Software	13533/2019 -CO/SW	Sakthivel Murugan.R (AP/Mech) Thanga Kasi Rajan.S (AP/Mech)	Registered	SW-13027/2019	02/12/2019	
3	PO-CO Attainment Calculation Sheet for Cycle Test and various assessments using MS Excel (Version 2)	Computer Software	14275/2019 -CO/SW	Sakthivel Murugan.R (AP/Mech) Thanga Kasi Rajan.S (AP/Mech) Madhan.N. R (AP/Mech)	Registered	SW-12999/2019	21/11/2019	

7.2.1. Best Practice II

Title of the Practice:

Online Teaching and Assessment Methodology using Online platform

Objective of the Practice:

- To deliver the lecture content through interactive video conferencing through Microsoft Teams
- Continuous monitoring of students attendance and their understanding of the delivered content through quiz (polling) in the chat window
- The lecture material can be shared by file sharing in the groups and Microsoft Whiteboard helps in live content description through diagrams and equations.
- Microsoft forms for conducting assignment and quiz for evaluating the students
- End semester examination is held through Hiermee app, AI based assessment platform through which proctored examinations are conducted

The Context:

- Due to pandemic situation, there exists a need for the academic institutes to shift from the traditional Teaching – Learning practice to online mode.
- Our Institute conducted interactive video online classes for teaching the curriculum through Microsoft Teams platform.
- As physical mode paper-based examinations could not be conducted due to COVID 19 ,for assessment of students understanding Microsoft Teams platform and Hiermee app were used .

The Practice:

The link for online video classes will be created through Teams and will be sent to respective class students through Microsoft Teams platform and the students can attend the classes through their mobile phone app itself. The attendance of the class can be downloaded at the end and in between the classes. The students can be assessed by posting questions through chat window. The responses for the questions

in the chat can be downloaded in an excel sheet and analyzed. The classes can be recorded and the video link can be sent to those students who were not able to attend due to valid reasons. Microsoft teams white board can be used for more interactive sessions.

The students can be grouped under a MS-Teams classroom and assignment/Internal test questions can be posted to this group. The deadline for submission can be fixed and the submission date and time of every student can be tracked, which helps in checking the timeliness of their submission. The evaluated scripts with their scores can be returned back through the same group.

End semester exams are conducted through Hiremee application, AI based proctoring where the students are continuously monitored and during the entire duration of exam, photos are captured at random times and if anything unwanted happenings detected, then the students are marked with red flag. The captured images are then manually checked for integrity by the faculty members. For each examination, a faculty member will be allotted as a proctor from the exam cell. The allotted proctor details will be shared with the students for sharing any discrepancy they face during their examinations. After completion of the exam on each day, the proctoring report of each student will be checked by the exam cell team member (reserve faculty) and the students those who got red flags (based on the honesty level), number of retry more than 4 times, Freezed status will be shared with the proctors and the proctors will submit the consolidated report in the exam cell. If any student faces internet connectivity issues, they need to communicate the same with the proctor and their respective Head of the Department , if it is genuine case, those students will be considered for re-examinations.

For those qualified students who attended the exam with truthfulness, results are declared.

Evidence of Success:

The students are given with all necessary information in prior for attending the online classes and taking the assessments. Faculty members are able to monitor the attendance and understanding of the students.

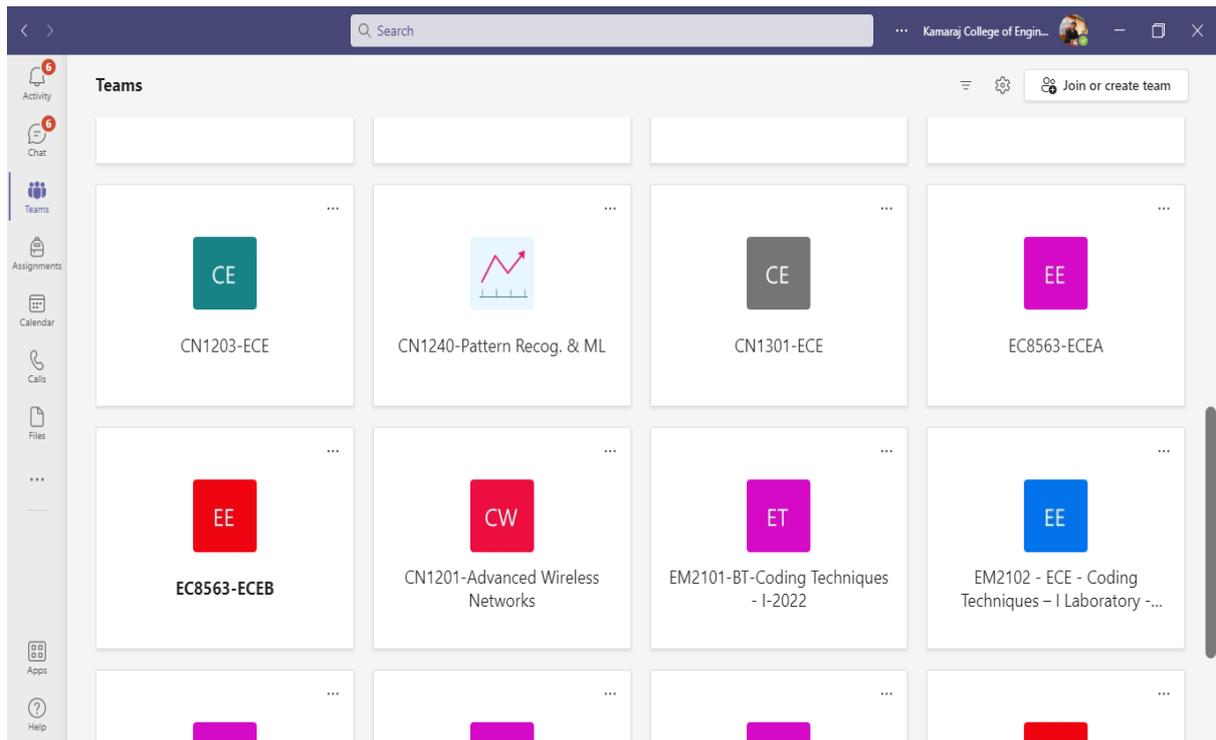
More than 95 % of students used to attend classes and the examination results of pass percentage being more than 90% show the effectiveness of the implemented system.

Problems Encountered and Resources Required:

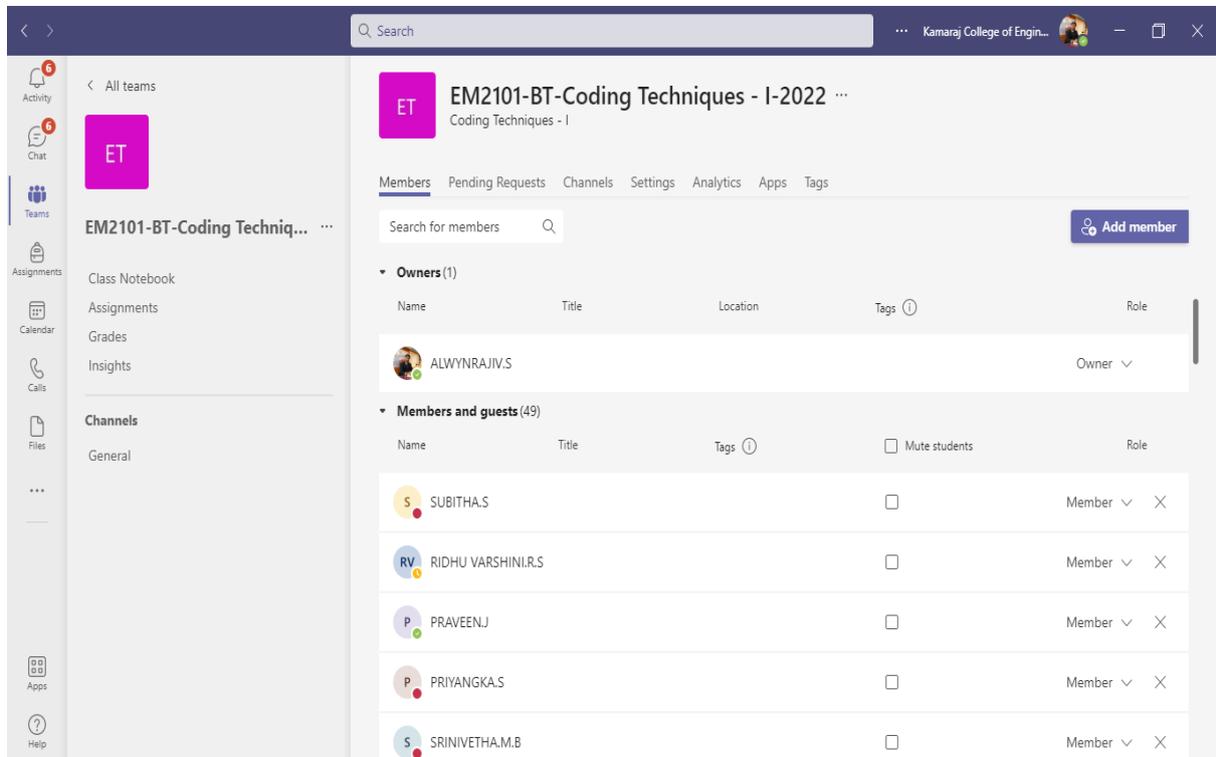
For attending the classes and taking the exam, all the students should have necessary networking and computing facility. If the students faced poor network connectivity due to bad climate or other reasons, then the students could not successfully complete their exams. The following steps are required in order to conduct webcam proctored test from a remote location in Hiremee Platform:

- A capable device (Desktop PC/Laptop/Tablet/Mobile)
- Stable internet connection with at least 256kbps speed and 2G bandwidth
- An effective webcam
- Modern browsers compatible with PC/Laptop (minimum windows 7 OS)
- Mobile Phone with Android / iOS and Hiremee App Installed through Google Playstore

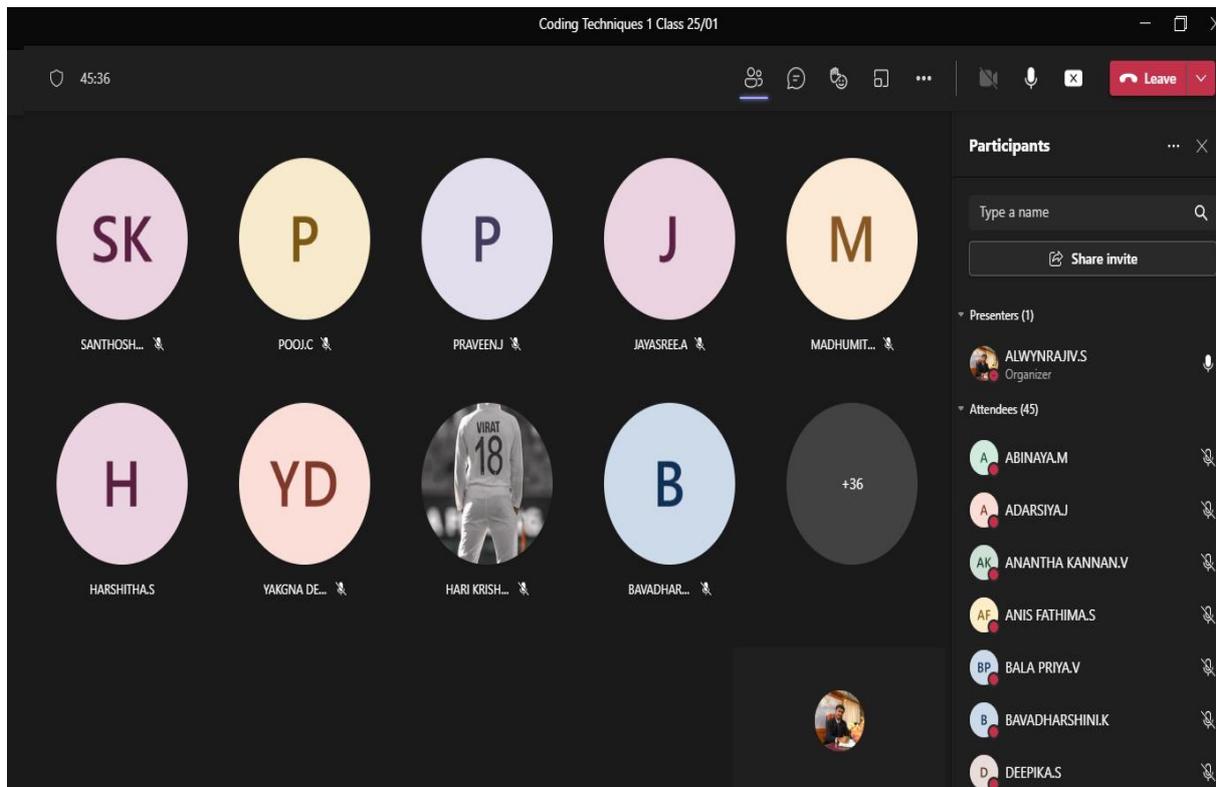
Class Room Environment in Microsoft Teams



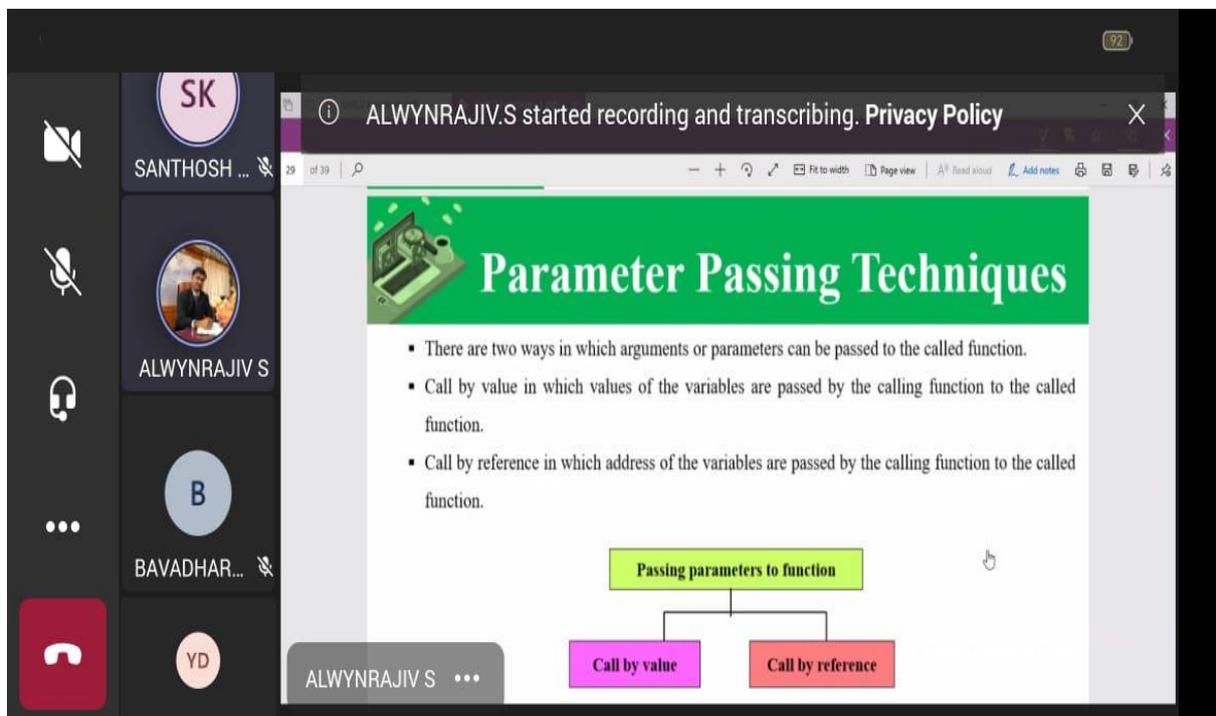
Students in a Class Room



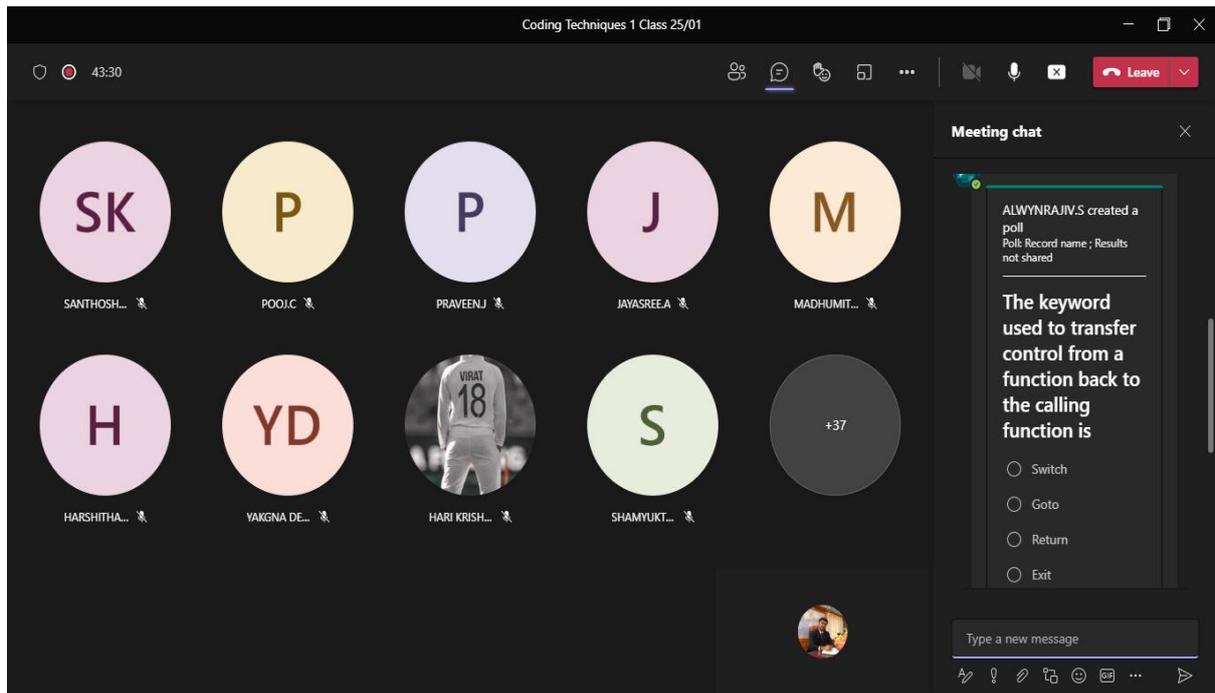
Students Attending Class – Faculty View



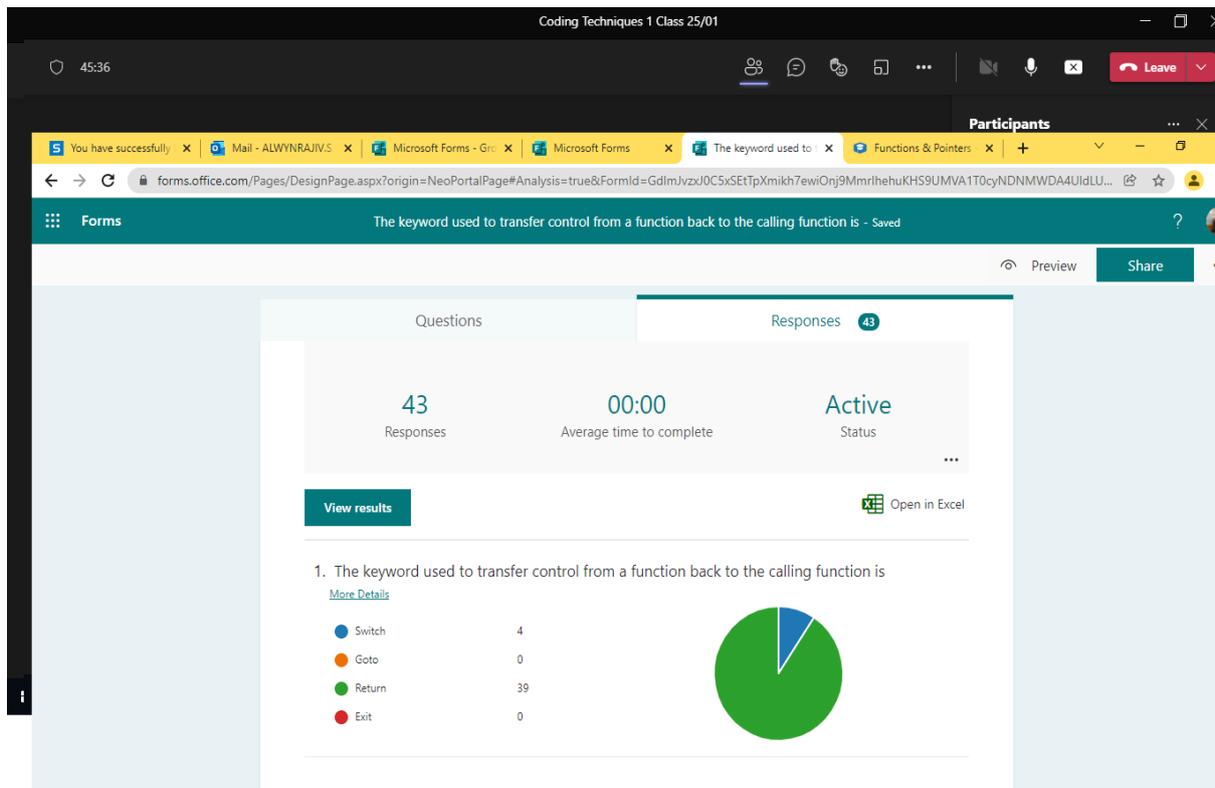
Students Attending Class – Student View



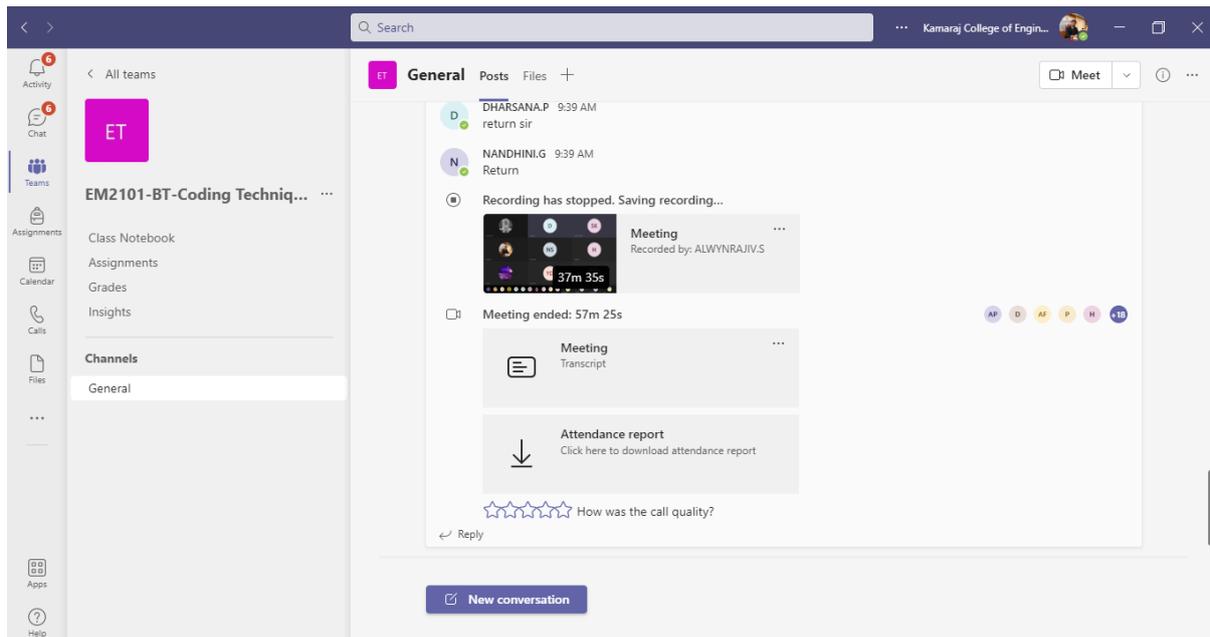
Learning Outcome Assessment by Using Poll Posted in Chat Box



Student Response



At the End of the Class Attendance and Recorded Video Available in Chat Box



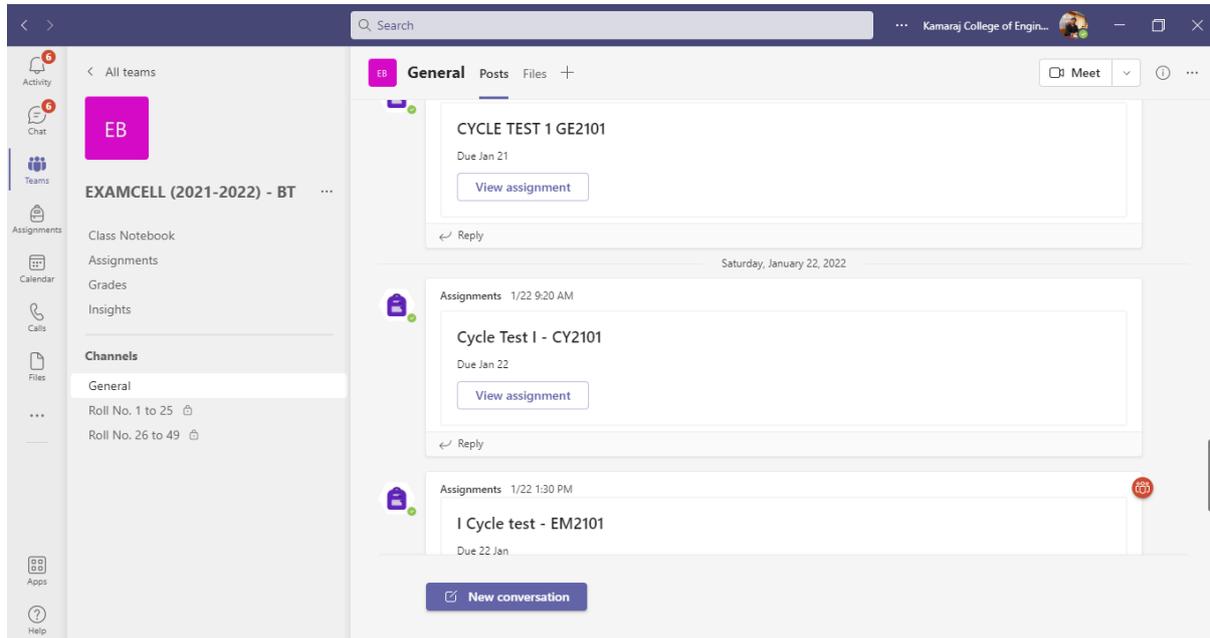
Student Attendance

02 hour 24_01 - Microsoft Excel (Product Activation Failed)

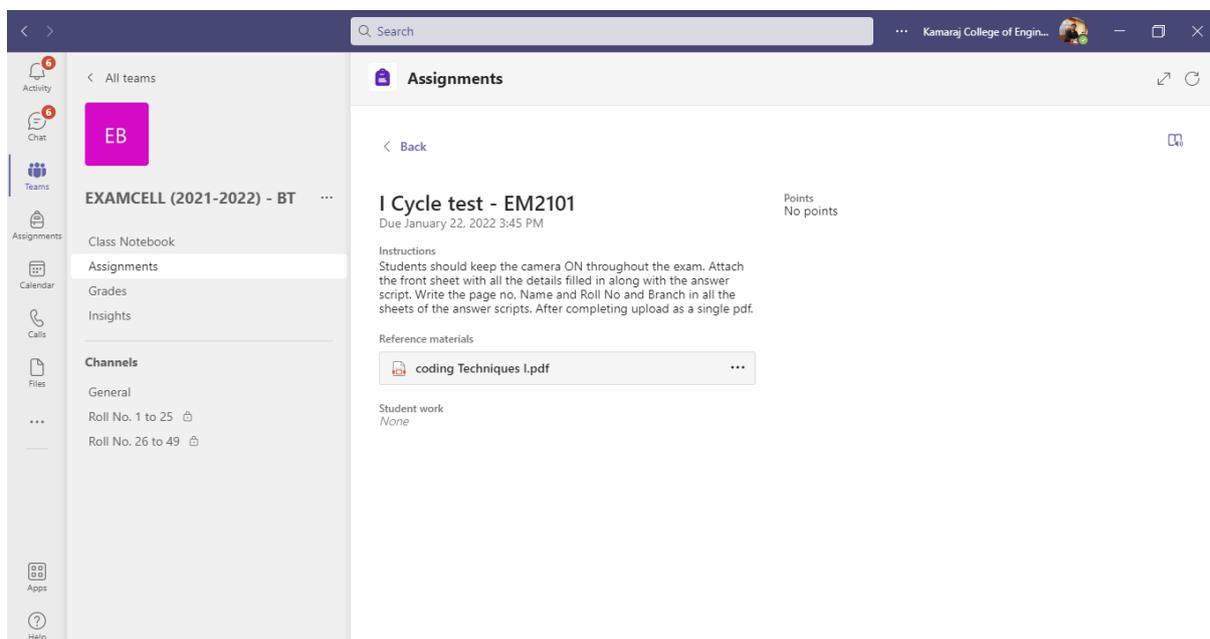
	A	B	C	D	F	G	H	I	J	K	L	M	N
1	Meeting Summary												
2	Total Number of Participants	50											
3	Meeting Title												
4	Meeting Start Time	1/24/2022, 9:48:07 AM											
5	Meeting End Time	1/24/2022, 10:43:04 AM											
6	Meeting Id	d7e8bba7-1e10-40e0-b4bb-30d80da99b73											
7													
8	Full Name	Join Time	Leave Time	Duration	Role	Participant ID (UPN)							
9	ALWYNRAJIV.S	1/24/2022, 9:48:07 AM	1/24/2022, 10:43:04 AM	54m 56s	Organizer	alwynece@kamarajengg.edu.in							
10	DHARSAN.K	1/24/2022, 9:48:38 AM	1/24/2022, 9:54:03 AM	5m 25s	Attendee	21ubt013@kamarajengg.edu.in							
11	DHARSAN.K	1/24/2022, 9:55:43 AM	1/24/2022, 10:42:06 AM	46m 22s	Attendee	21ubt013@kamarajengg.edu.in							
12	VIJAYA SHREE.V	1/24/2022, 9:51:47 AM	1/24/2022, 10:42:06 AM	50m 18s	Attendee	21ubt029@kamarajengg.edu.in							
13	ANANTHA KANNAN.V	1/24/2022, 9:55:31 AM	1/24/2022, 10:42:19 AM	46m 48s	Attendee	21ubt005@kamarajengg.edu.in							
14	SANMITAA.S	1/24/2022, 9:55:48 AM	1/24/2022, 10:42:08 AM	46m 20s	Attendee	21ubt031@kamarajengg.edu.in							
15	HARSHITHA.S	1/24/2022, 9:55:52 AM	1/24/2022, 10:42:14 AM	46m 22s	Attendee	21ubt037@kamarajengg.edu.in							
16	PRIYANGKA.S	1/24/2022, 9:55:54 AM	1/24/2022, 9:56:23 AM	28s	Attendee	21ubt048@kamarajengg.edu.in							
17	PRIYANGKA.S	1/24/2022, 10:02:22 AM	1/24/2022, 10:42:05 AM	39m 42s	Attendee	21ubt048@kamarajengg.edu.in							
18	SASIBALAN.M	1/24/2022, 9:55:54 AM	1/24/2022, 10:42:50 AM	46m 55s	Attendee	21ubt033@kamarajengg.edu.in							
19	HARI KRISHNAN.A.M	1/24/2022, 9:55:58 AM	1/24/2022, 10:42:43 AM	46m 45s	Attendee	21ubt036@kamarajengg.edu.in							
20	ADARSIYA.J	1/24/2022, 9:55:59 AM	1/24/2022, 10:42:10 AM	46m 10s	Attendee	21ubt030@kamarajengg.edu.in							
21	SANTHOSH KAVERI.SR	1/24/2022, 9:56:01 AM	1/24/2022, 10:42:13 AM	46m 11s	Attendee	21ubt001@kamarajengg.edu.in							
22	SRINIVETHA.M.B	1/24/2022, 9:56:03 AM	1/24/2022, 10:42:08 AM	46m 4s	Attendee	21ubt028@kamarajengg.edu.in							
23	GAJALAKSHMI.K	1/24/2022, 9:56:05 AM	1/24/2022, 10:42:55 AM	46m 50s	Attendee	21ubt006@kamarajengg.edu.in							
24	DIVYA IOTHI.K	1/24/2022, 9:56:07 AM	1/24/2022, 10:42:11 AM	46m 4s	Attendee	21ubt004@kamarajengg.edu.in							
25	JAYASREE.A	1/24/2022, 9:56:13 AM	1/24/2022, 10:42:14 AM	46m	Attendee	21ubt040@kamarajengg.edu.in							

Formative Assessment by Using Video Proctoring Method by using MS-Teams

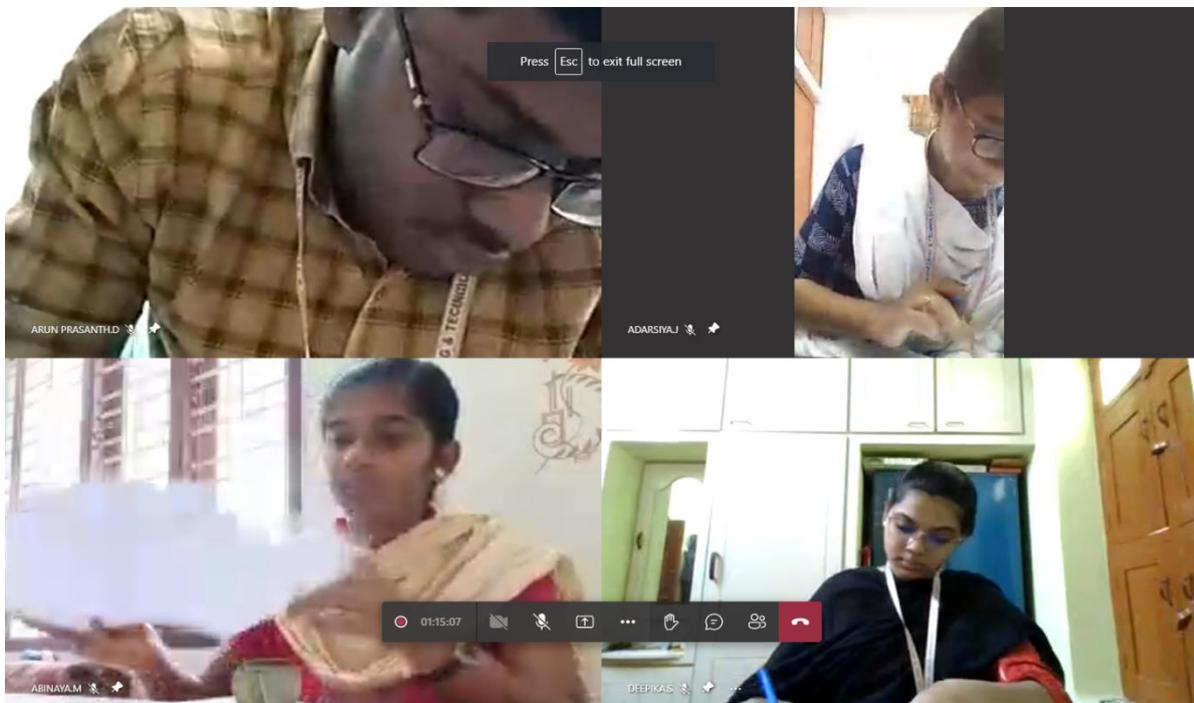
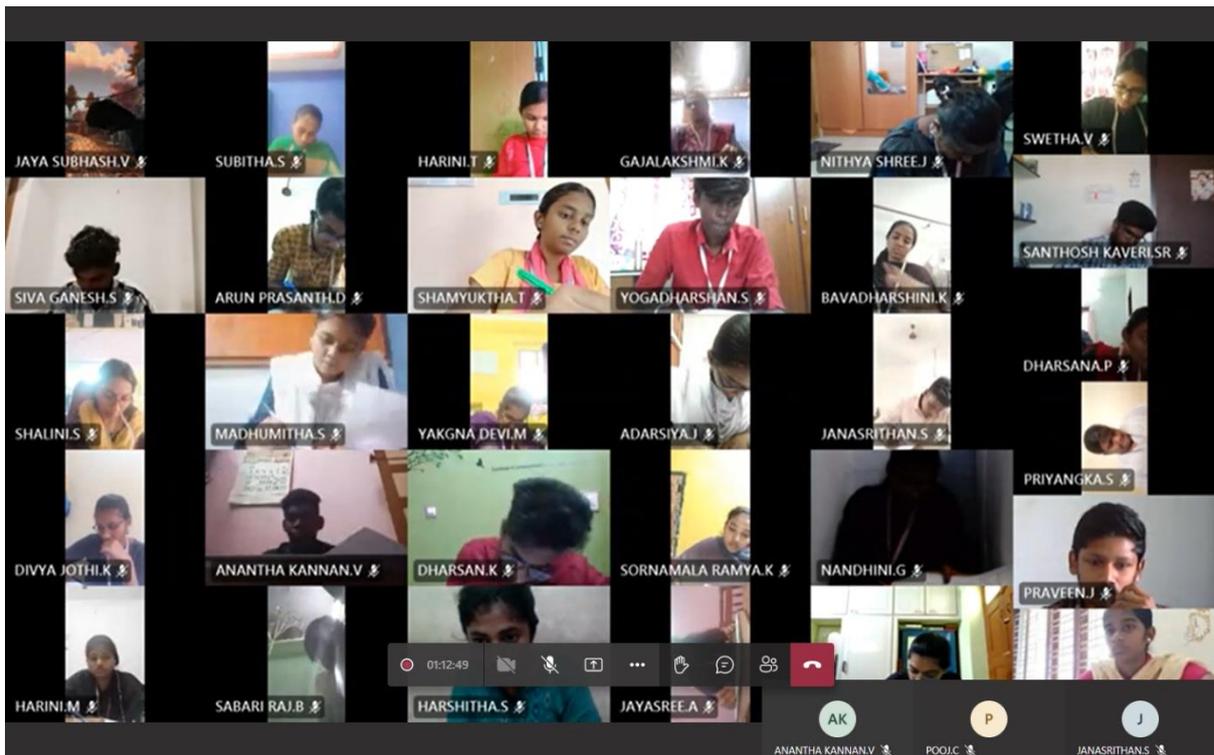
Question Paper Posted in Assignment



Question Paper View – Students



Video Protecting by Faculty Members



Student Submit their Answer Script

The screenshot shows the Microsoft Teams interface for a team named 'EXAMCELL (2021-2022) - BT'. The 'Assignments' section is active, displaying a list of 13 assignments, all of which have been 'Turned in' by the students. The list includes student names and their profile pictures.

Student Name	Status
GAJALAKSHMI.K	Turned in
HARI KRISHNAN.A.M	Turned in
HARINILM	Turned in
HARINILT	Turned in
HARSHITHA.S	Turned in
JANASRITHAN.S	Turned in
JAYA SUBHASH.V	Turned in
JAVASREE.A	Turned in
KRISHA.K.S.	Turned in
MADHUMITHA.S	Turned in
MOHANA KANNAN.N	Turned in
MUTHU GANESH.S	Turned in

Answer Script View – Faculty Members

The screenshot shows a faculty member's view of a student's answer script. The document is titled '21ubt036_HARIKRISHNAN.pdf'. The script is from Kamaraj College of Engineering & Technology and is an 'INTERNAL ASSESSMENT TEST I II III'. The document includes a header with the college name and logo, and a table for marking the script. The right-hand side of the interface shows a chat window with the student's name 'HARI KRISHNAN.A...' and a 'Feedback' section with a text input field and a 'Return' button.

Document Header:
KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY
 (An Autonomous Institute, Affiliated to Anna University, Chennai)
 B.E. in Information Technology - 4th Year
 Assessed by IMAC with 'A' Grade

INTERNAL ASSESSMENT TEST I II III

Register Number	9 2 0 4 2 1 0 3 6
Degree & Branch	B.E. Information Technology
Course Code & Name	EW2023 Coding Techniques
Year & Semester	3 rd 2 nd All participants given an overall
Date & Section	22 nd 23 rd Department/Signature of the Hall Supdt. with Date
No. of Pages used	8 pgs. Name of the Hall Superintendent

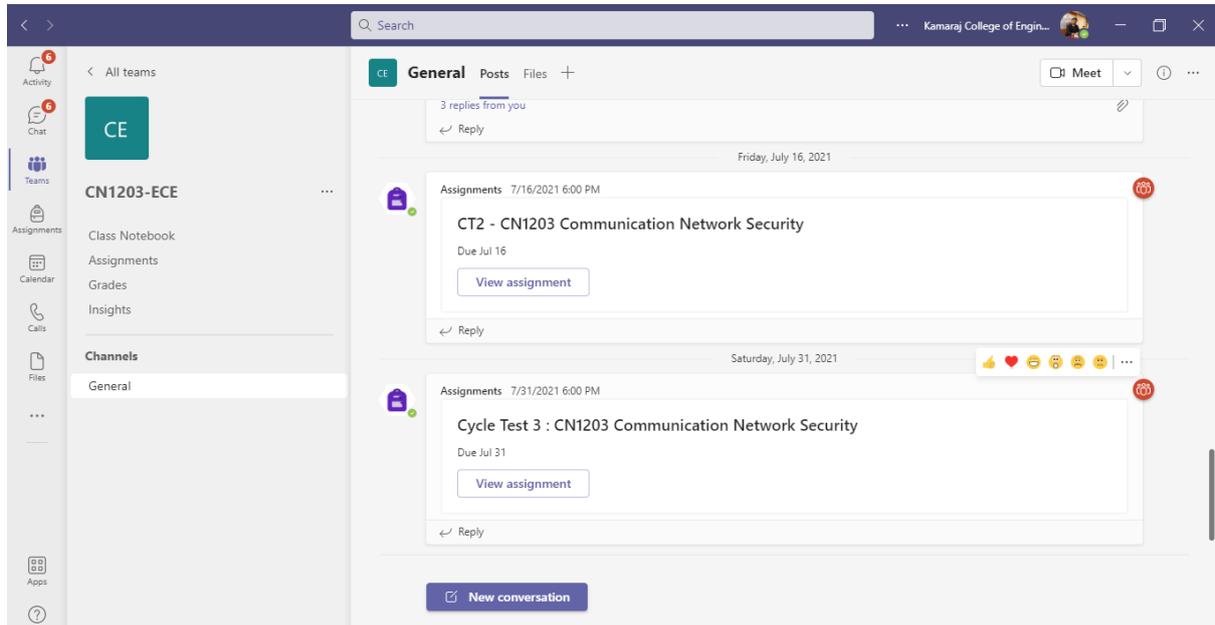
Marking Table:

Question No.	Marks	Question No.	Marks				Total
			I	II	III	IV	
1	8	A					
2		B					
3							
4		A					
5		B					
		A					
		B					
Total							

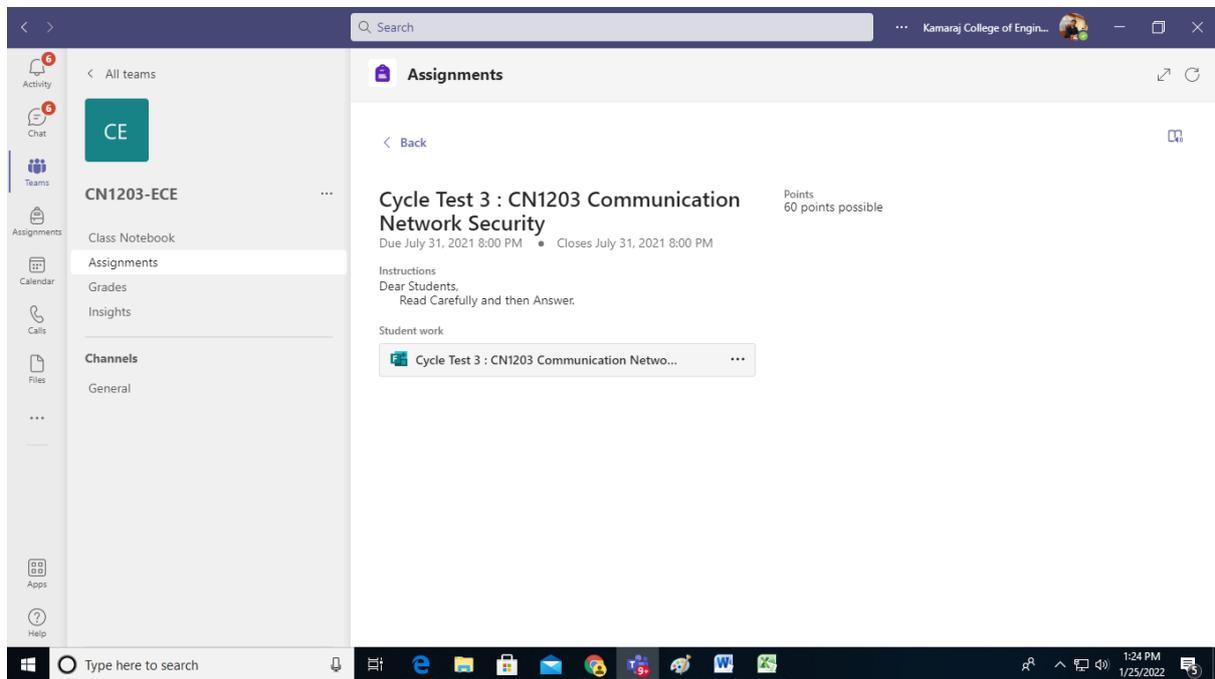
Grand Total (in words): Grand Total:

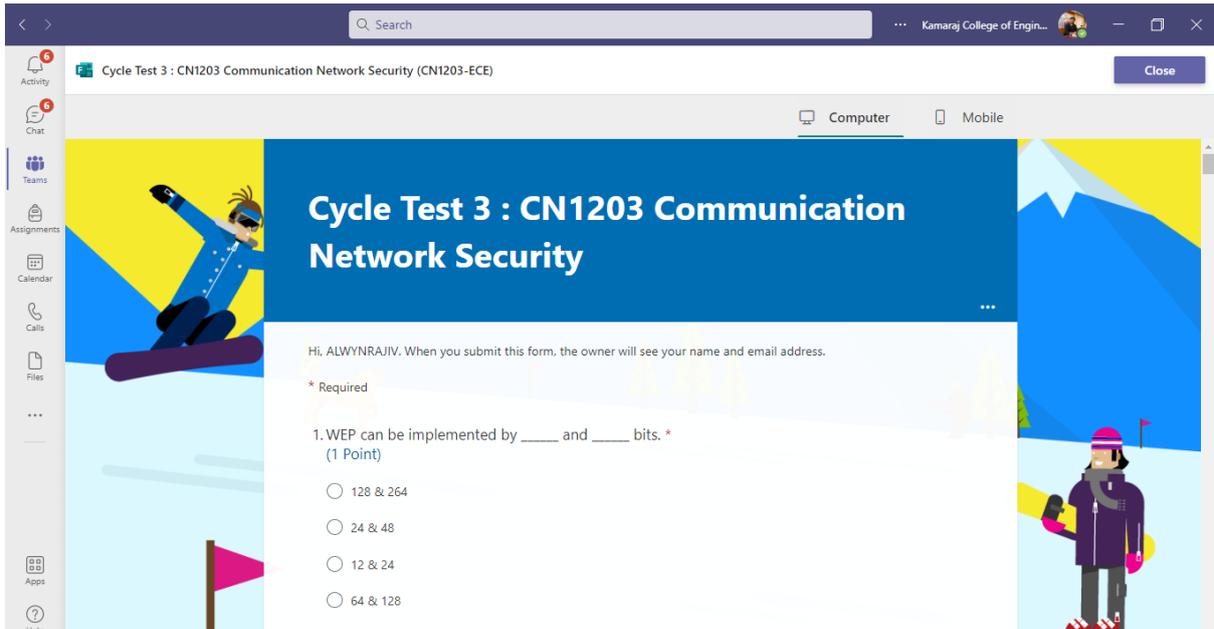
Formative Assessment by using MCQ

Cycle Test Question Posted in Assignment

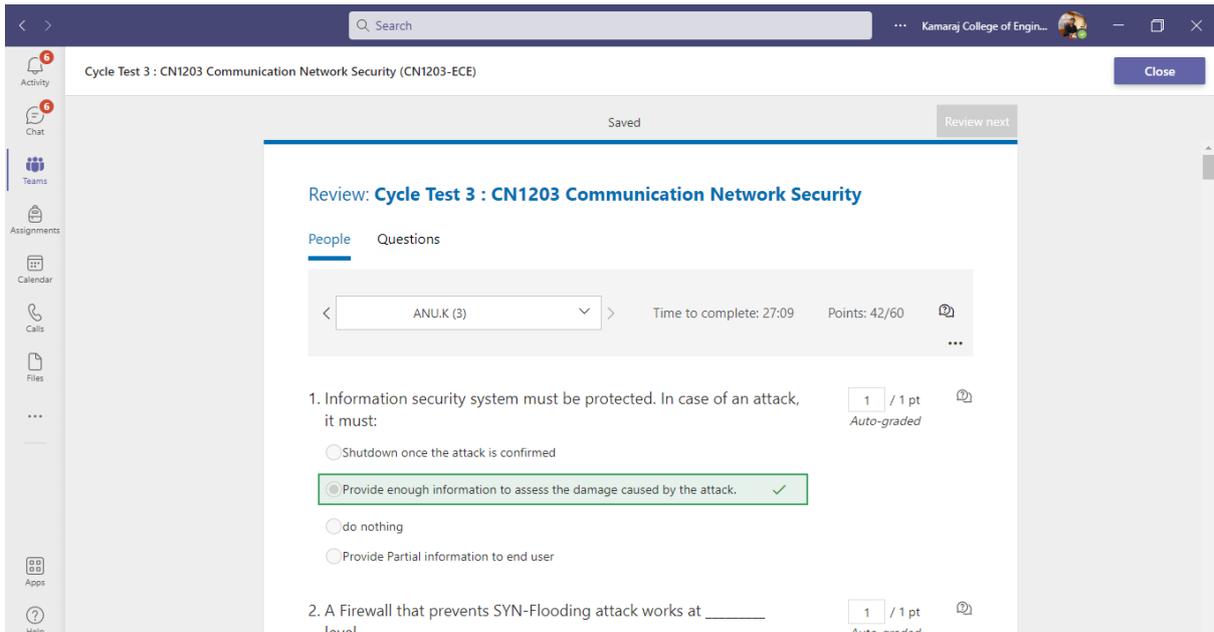


Student View





Auto Graded After Completing the Exam



Microsoft Teams interface showing the 'Assignments' section for the team 'CN1203-ECE'. The assignment is titled 'Cycle Test 3 : CN1203 Communication Network Security' with a due date of July 31, 2021, 8:00 PM. The assignment status is 'Returned (4)'.

To return (1)	Returned (4)	Search students	
<input type="checkbox"/>	Name ▾	Status ▾	Feedback / 60
<input type="checkbox"/>	A ANU.K	← Returned	42 ✓
<input type="checkbox"/>	B BRESSH.G	← Returned	58 ✓
<input type="checkbox"/>	N NIVETHA.M	← Returned	58 ✓
<input type="checkbox"/>	SA SAI ANIRUDH.R	← Returned	58 ✓

Assessment in Forms in Microsoft Office

Microsoft Forms interface showing a grid of assessment forms. The forms are displayed in a grid layout with various titles and response counts.

Title	Responses
Stop and Wait is a _____ techniq	75 responses
GE1281 - Engineering Practice Lab - E	27 responses
GE1281 - Engineering Practice Lab - E	28 responses
EC8093-Digital Image Processing PRE	24 responses
Opinion from PG Students on End Se	19 responses
GE1281 Engineering Practices Lab Ans	58 responses
EPL Electronics Exp: 4 - Assessment	0 responses
EPL Electronics Exp: 6 - Assessment	0 responses

Summative Assessment in HireMee

Airtel|airtel VoLTE 4G 0.00K/s 46% 4:33 pm

← Test PIN

Choose your Assessment mode

PRO Assessment

Gold Assessment

Test Event

Enter Your Assessment Test PIN

H597543

Submit



Exam Instruction

Read All Instructions Carefully:

1. A minimum internet speed of 512 kbps speed is required.
2. Turn off all chat applications.
3. Do not navigate away from the test window while taking the test.
4. Only in case of power failure, internet failure re-enter the same credentials to finish your test. The test will resume from the same instance where it got disrupted.
4. The Test Pin is for one-time use only.
5. Do not forget to click on the End Test once the test is completed.
6. Keep an eye on the Timer displayed on the screen.
7. There is No Negative Marking.

I read all the Instructions

Proceed



HireMee Mock Test

End Test



KCET - Mock Test



Name : Alwyn Rajivs

TestPin : H597543

Duration :00:30:00

Completed

In Completed

Not Started

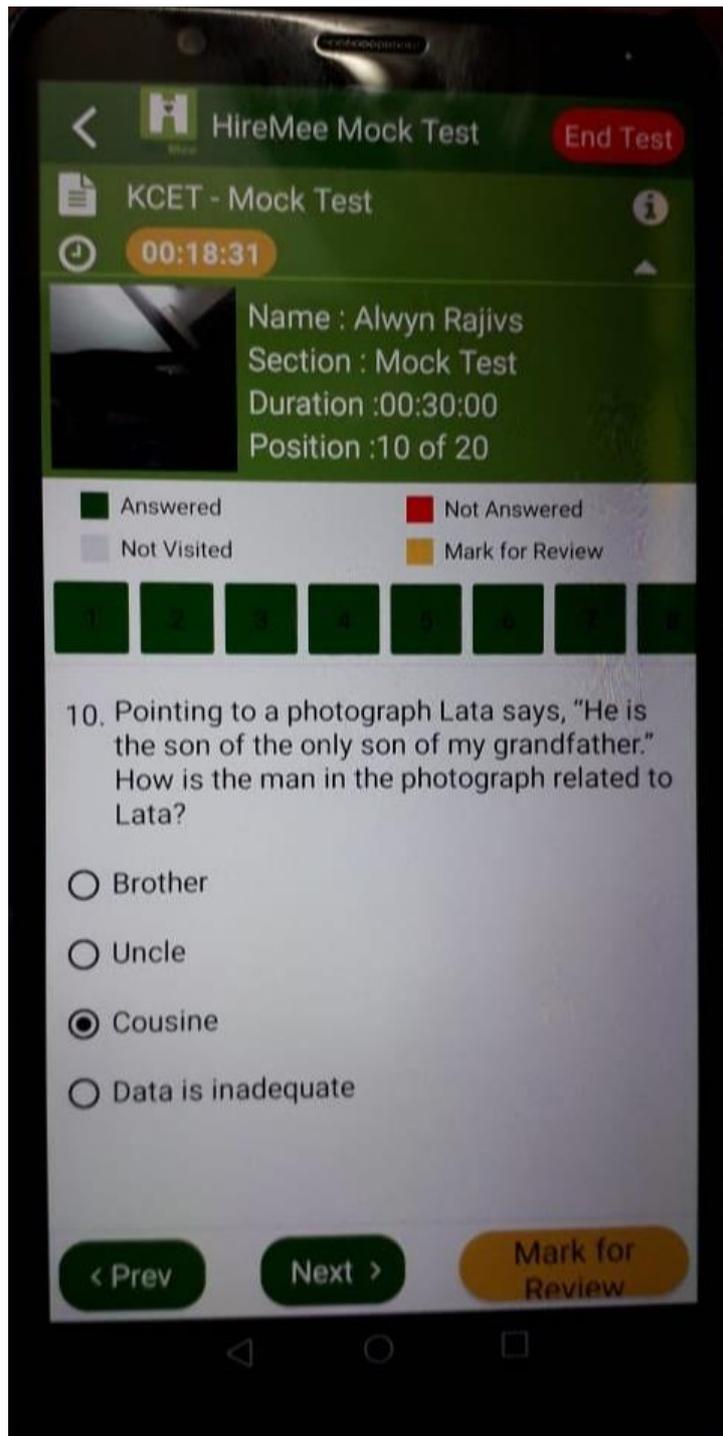
Freezed

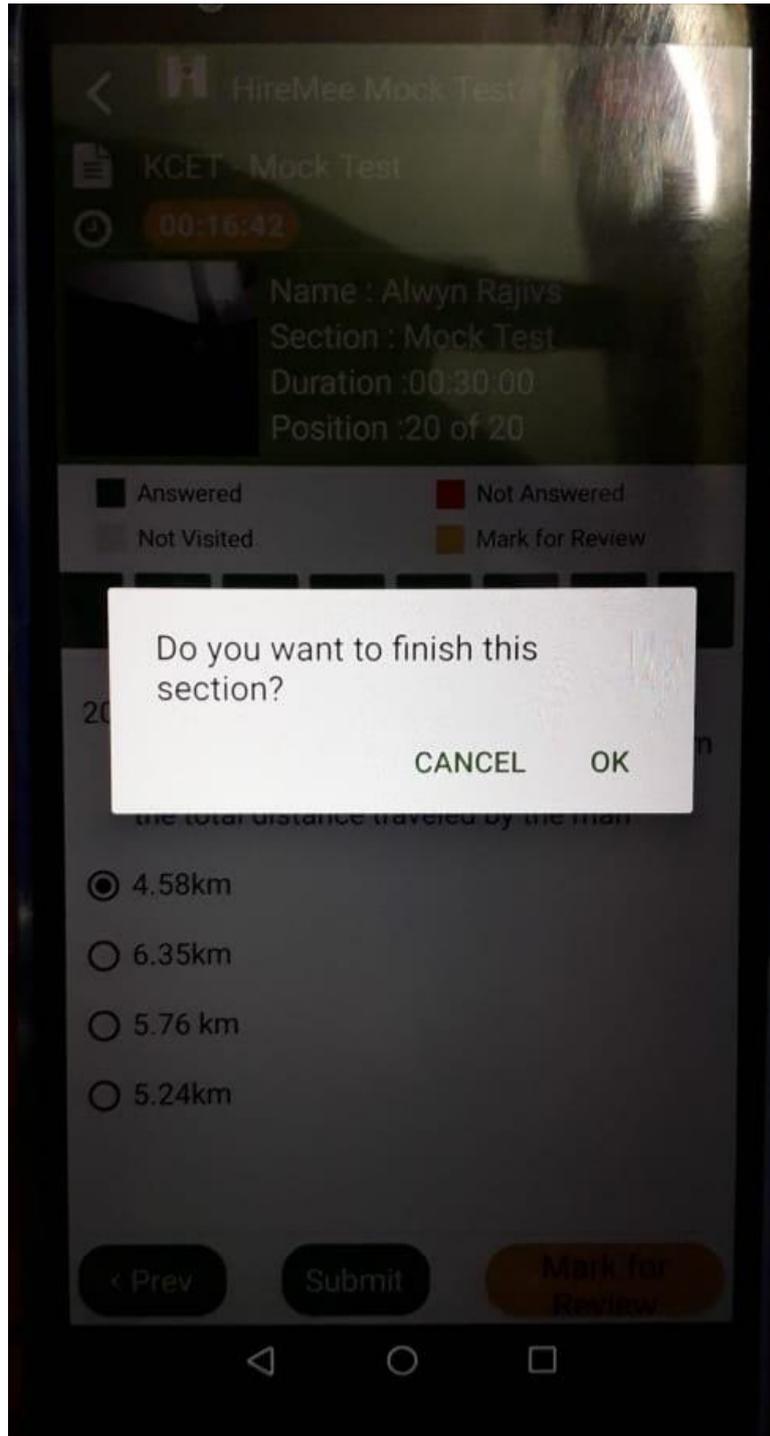
Mock Test



? Total Questions : 20

Start Exam





Honest Level

H520795	2020-11-21 11:01:28	Cycle Test 3 BT8004 Advanced Biochemistr	ADARSH ROHAN.B.	18ubte002 @kamaraje ngg.edu.in	50%	N/A	N/A		View Report	Candidate Transcript
H819824	2020-11-21 11:00:21	Cycle Test 3 BT8004 Advanced Biochemistr	ALLAN BLESSING HARISON RA.JA.	18ubte028 @kamaraje ngg.edu.in	50%	N/A	N/A		View Report	Candidate Transcript

Sample Proctoring Report

11:00:21 am	Candidate has started the assessment.
11:00:45 am	Custom Form inserted successfully
11:00:53 am	Question Set Created Successfully
11:27:30 am	Assessment completed and report published
11:27:59 am	Custom Feedback inserted successfully
11:27:59 am	Custom Feedback inserted successfully
11:27:59 am	Custom Feedback inserted successfully
11:27:59 am	Custom Feedback inserted successfully
11:27:59 am	Custom Feedback inserted successfully
11:27:59 am	Custom Feedback inserted successfully

Sample Window Proctoring Report

12:03:59 pm	Candidate has started the assessment.
12:04:13 pm	Custom Form inserted successfully
12:04:51 pm	Profile image taken for image proctoring
12:04:57 pm	Question Set Created Successfully
12:07:33 pm	Candidate navigates away from assessment window
12:08:00 pm	Candidate resumes the assessment
12:13:33 pm	Assessment completed and report published
12:14:27 pm	Custom Feedback inserted successfully

Image Proctoring Report

Proctoring Report Screen Capture Preview

1 out of 53

Screen captured at consecutive timestamp while assessment

Proctoring Report Screen Capture Preview

1 out of 25

Screen captured at consecutive timestamp while assessment

[Download](#)