To ensure the fitness of higher education system to negotiate new challenges, adaptation of proper academic frameworks and strategic interventions are necessary. Outcome Based Education (OBE) framework has emerged as a major reform model in the global engineering education scenario and has been mandated for accreditation of engineering programs for the Washington accord signatories. The OBE approach is based on a student centered learning philosophy and focuses on the output (outcomes) instead of the input (content). KLE Technological University has adopted Outcome Based Education (OBE) Framework for curriculum design, teaching and assessment. The framework gives us an opportunity to build a culture of continuous improvement that strengthens our academic quality and inspires student achievement.

Program Outcomes (POs) & Program Specific Outcomes (PSOs) :

The Program Outcomes defined by the NBA and Program Specific Outcomes as defined by the program for mechanical engineering are as shown below as an example. Similar exercise has been carried out by all the programs of the university.

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 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 public health and safety, and cultural, societal, and environmental considerations.

PO 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.

PO 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.

PO 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.

PO 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.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 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.

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

PSO 1: Engineering Drawing & Modelling: Use modern CAD tools and appropriate design standards to develop component and system drawings.

PSO 2: Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost.

PSO 3: Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools.

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Examples of Course Outcomes:

Course Outcomes (COs) are central to the course's curriculum. A course Outcome is a measurable, observable, and specific statement that clearly indicates what a student should know and be able to do as a result of learning.

A few examples of course outcomes from the school of mechanical engineering for a course each from 4th Semester BE and 7th Semester BE are presented here.

Semester: **IV** **Year: 2021-22**

Course Title: **Engineering Materials** Course Code:**15EMEF202**

Prerequisites:

This subject requires the student to know about Elements of Mechanical Engineering, Engineering Mathematics, Engineering Physics, Engineering Chemistry and Mechanics of Materials.

Course Outcomes-(CO)

At the end of the course student will be able to:

1. Describe the role of engineering materials in the design of systems and their selection strategy.
2. Apply the knowledge of crystal structure and deformation behavior to select appropriate material.
3. Select an appropriate engineering material for an application that responds to applied mechanical loads in both a macroscopic and microscopic sense at ambient temperature and high temperature scenarios.
4. Explain the concepts of solid solutions as a basis for constructing phase diagrams.
5. Identify a suitable material (Ferrous or Nonferrous) for a given application from standards.
6. Demonstrate the knowledge of heat treatment process for improving physical and mechanical properties of engineering materials.
7. Elucidate the need, properties and applications of ceramics, polymers and composite materials.

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Semester:**7th Semester** Year: **2021-22**

Course Title: **Operations Research** Course Code: **15EMEC401**

Prerequisites:

This subject requires the knowledge of Vectors and linear algebra, Matrices and determinants, linear simultaneous equations**,** and Different production functions. The knowledge of Excel will be an added advantage.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. **Outline** the fundamentals and importance of the Operations Research as a study of manufacturing/business system optimization using mathematical models.
2. **Apply** linear programming technique to find out the solution feasible for making maximum profit or to minimize the loss or utilize the production capacity to the maximum extent.
3. **Carry** out sensitivity analysis using duality theory concepts.
4. Formulate and solve transportation and assignment problems using the MODI method and Hungarian method respectively.
5. Formulate and solve network problems using minimum spanning tree, shortest route and maximum flow algorithms and project management problems using CPM and PERT techniques
6. **Construct** a strategic game with market information or given business situation

Course Articulation Matrix and Program Articulation Matrix:

Two Important tools that help us to understand extent of compliance of the curriculum with POs and PSOs are

i. Course Articulation Matrix
ii. Program Articulation Matrix

An example of the above for Mechanical Engineering program are shown in the following section.

i. Course Articulation Matrix

For each of the courses offered in the program, course articulation matrix is prepared. The course articulation matrix:

- Identifies how COs contribute to achievement of PO's
- can reveal gaps in the curriculum or prompt re-examination of COs

A typical format for course articulation matrix is shown :

Course Title: Analytical geometry and calculus Course code: 18EMAB101 Semester: I/II

Course Code: **18EMAB101**		Course Title: **Analytical geometry and calculus**											
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
18EMAB101.1	Formulate the equations for real world problems using exponential, logarithmic, trigonometric functions and solve the problems.	3	1	-	-	-	-	-	-	-	-	-	-
18EMAB101.2	Apply limits and continuity concept to solve the problems and also find the roots of an equation using Bisection and Newton Raphson methods.	3	1	-	-	-	-	-	-	-	-	-	-
18EMAB101.3	Explain the meaning of derivatives of function and their applications to find the maximum and minimum values of functions.	3	1	-	-	-	-	-	-	-	-	-	-
18EMAB101.4	Approximate the given function by a series and discuss its convergence.	3	1	-	-	-	-	-	-	-	-	-	-

18EMAB101.5	Find arc length, area, volume and surface area using integrals analytically and numerically	3	2	-	-	-	-	-	-	-	-	-	-
18EMAB101.6	Find work done, moment of force about a point and line using vectors. Sketch the quadratic surfaces.	3	1	-	-	-	-	-	-	-	-	-	-

Course Code: **15EMEF202**		Course Title: **Engineering Materials**													
CO Code	**Course Outcomes (CO)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
15EMEF202.1	Describe the role of engineering materials in the design of systems and their selection strategy.	**2**	--	--	--	--	--	--	--	--	--	--	--	--	--	
15EMEF202.2	Apply the knowledge of crystal structure and deformation behavior to select appropriate material.	--	**2**	--	--	--	--	--	--	--	--	--	--	--	--	
15EMEF202.3	Select an appropriate engineering material for an application that responds to applied mechanical loads in both a macroscopic and microscopic sense at ambient temperature and high temperature scenarios.	--	**3**	--	--	--	--	--	--	--	--	--	--	--	--	
15EMEF202.4	Explain the concepts of solid solutions as a basis for constructing phase diagrams.	--	**2**	--	--	--	--	--	--	--	--	--	--	--	--	--
15EMEF202.5	Identify a suitable material (Ferrous or Nonferrous) for a given application from standards.	**2**		--	--	--	--	--	--	--	--	--	--	--	--	
15EMEF202.6	Demonstrate the knowledge of heat treatment process for improving physical and mechanical properties of engineering materials.	**2**		--	--	--	--	--	--	--	--	--	--	--	--	--
15EMEF202.7	Elucidate the need, properties and applications of ceramics, polymers and composite materials.	**2**		--	--	--	--	--	--	--	--	--	--	--	--	--

1: Low 2: Medium 3:High "-": No Correlation

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Course Code: 15EMEC401															
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
15EMEC401.1	Outline the fundamentals and importance of the Operations Research as a study of manufacturing/business system optimization using mathematical models.	--	**2**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.2	Apply linear programming technique to find out the solution feasible for making maximum profit or to minimize the loss or utilize the production capacity to the maximum extent.	--	**1**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.3	Carry out sensitivity analysis using duality theory concepts	--	**2**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.4	Formulate and solve transportation and assignment problems using the MODI method and Hungarian method respectively	--	**3**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.5	Formulate and solve network problems using minimum spanning tree, shortest route and maximum flow algorithms and project management problems using CPM and PERT techniques	--	**3**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.6	**Construct** a strategic game with market information or given business situation	--	**3**	--	--	--	--	--	--	--	--	--	--	--	--
15EMEC401.7	Communicate the results of an operations research case/project through a written report and an oral summary	--	--	--	--	**2**	--	--	--	--	**2**	--	--	--	--

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3rd Semester **Course Code: 15ECSC203** **Course: Data Structures with C**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
15ECSC203.1	Explain the need for data structuring techniques.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
15ECSC203.2	Implement standard data structures like stack, queue, list and trees.	2	-	-	-	-	-	-	-	-	-	-	-	-	3
15ECSC203.3	Demonstrate the use of standard data structures using relevant applications.	3	-	-	-	-	-	-	-	-	-	-	-	-	3
15ECSC203.4	Compare the performance of applications built using different data structures.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
15ECSC203.5	Choose appropriate data structures while building applications.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
15ECSC203.6	Design own data structures based on the need.	-	-	1	-	-	-	-	-	-	-	-	-	-	-
15ECSC203.7	Apply the C language concepts: pointers, structures, unions, files and recursion to solve problems.	-	-	-	-	-	-	-	-	-	-	-	-	-	3
15ECSC203		**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

4th Semester **Course Code: 17ECSC202** **Course: Principles of Compiler Design**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
17ECSC202.1	Design a suitable computing machine / parser for a given formal language.	3	-	-	-	-	-	-	-	-	-	-	-	-	-
17ECSC202.2	Analyze the semantic analyzer for a given context free grammar of a language construct.	-	-	2	-	-	-	-	-	-	-	-	-	-	-
17ECSC202.3	Build and optimize the intermediate code for given programming construct.	-	3	-	-	-	-	-	-	-	-	-	-	-	-
17ECSC202.4	Implement the algorithms required for compiler front end construction..	-	-	-	2	-	-	-	-	-	-	-	-	-	-
17ECSC202		**3**	**3**	**2**	**2**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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5th Semester **Course Code: 15ECSW301** **Course: Mini Project**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
15ECSW301.1	Design a system for a given SRS using appropriate design methodology and prepare Design Document (DD).	-	-	3	-	-	-	-	-	-	-	-	-	-	-
15ECSW301.2	Construct a system for the given Design Document and perform testing.	-	-	3	-	-	-	-	-	-	-	-	-	-	-
15ECSW301.3	Construct the software and perform testing	-	-	-	-	2	-	-	-	-	-	-	-	-	3
15ECSW301.4	Develop presentation and technical writing skills.	-	-	-	-	-	-	-	-		2	-	-	-	-
15ECSW301.5	Work in a team to meet the set objectives.	-	-	-	-	-	-	-	-	2		-	-	-	-
15ECSW301		**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**3**

8th Semester **Course Code: 18ECSW401** **Course: Capstone Project**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
18ECSW401.1	Identify the problem and perform requirement analysis.	-	3	-	-	-	-	-	-	-	-	-	-	-	-
18ECSW401.2	Design potential solutions and evaluate to select optimal solution	-	-	3	-	-	-	-	-	-	-	-	-	-	3
18ECSW401.3	Apply professional norms of project implementation to meet specified requirements.	-	-	-	-	3	-	-	-	-	-	-	-	-	-
18ECSW401.4	Apply the fundamental activities of module, integration and system testing to validate the system.	-	-	-	-	-	2	-	-	-	-	2	-	-	-
18ECSW401.5	Analyze results and present technical/scientific findings effectively through written and oral mode.	-	-	-	-	-	-	-	-	3	3	-	-	-	-
18ECSW401		**-**	**3**	**3**	**-**	**3**	**2**	**-**	-	**3**	**3**	**2**	**-**	**-**	**3**

ii. Program Articulation Matrix

Once the course articulation matrices have been prepared, a program articulation matrix can be constructed that gives a concise summary of how and where the program outcomes are addressed by the core courses of the curriculum. It also provides an effective strategy for articulating, aligning and integrating program outcomes across a sequence of courses. It helps us to ensure that all outcomes are addressed at some course in the program

Most importantly, it also helps us determine whether there is enough emphasis on each of the program outcomes. Where there is not visible strong match, attempts are made to revise course contents or delivery methods to overcome the gaps. Program Articulation Matrix for Computer science and Engineering Program is presented below.

Program Articulation Matrix of the Computer science and Engineering Program

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
18EMAB101	3	2	-	-	-	-	-	-	-	-	-	-	-	-
15EPHB101	3	-	-	1	-	-	-	-	-	-	-	-	-	-
15ECVF101	3	-	-	-	-	-	2	-	-	-	-	-	-	-
18ECSP101	2	-	-	-	3	1	-	-	-	2	-	-	-	-
18EEEF101	3	-	-	-	-	1	-	-	-	-	-	1	-	-
15EHSP101	-	1	1	-	1	1	-	1	1	1	-	2	-	-
16EPHP101	2	-	-	1	1	-	-	-	-	-	-	-	-	-
18EMAB101	3	2	-	-	-	-	-	-	-	-	-	-	-	-
15ECHB101	2	-	-	-	-	-	-	-	-	-	-	-	-	-
18ECSP101	-	-	3	-	-	1	-	-	-	-	-	-	-	-
15EMEF101	2	-	1	-	-	1	2	2	-	1	-	1	-	-
18EECF102	3	-	2	-	-	-	1	-	-	-	-	-	-	-
15EHSH101	2	-	-	-	-	1	-	1	1	2	-	1	-	-
15ECRP101	-	-	2	-	2	-	-	-	-	-	-	-	-	-
15EMAB204	3	-	-	-	-	-	-	-	-	-	-	-	-	-
19ECSC202	3	-	-	-	-	-	-	-	-	-	-	-	-	-
20ECSC201	3	-	-	-	-	-	-	-	-	-	-	-	-	-

20ECSC205	3	-	2	-	-	-	-	-	-	-	-	-	-	3
19ECSC203	3	-	-	-	2	-	-	-	-	-	-	-	-	-
19ECSP201	3	-	2	-	-	-	-	-	-	-	-	-	-	3
20ECSP202	3	-	-	3	-	-	-	-	2	-	-	-	-	-
20EMAB209	3	-	-	-	-	-	-	-	-	-	-	-	-	-
20ECSC206	3	3	2	-	-	-	-	-	-	-	-	-	-	-
20ECSC204	3	3	2	-	-	-	-	-	-	-	-	-	-	-
15ECSC208	3	2	-	-	-	-	-	-	-	-	-	-	-	-
18ECSC202	3	3	-	-	-	-	-	-	-	-	-	-	-	-
15ECSP204	-	-	-	-	1	-	-	-	-	-	-	-	-	3
20ECSP203	3	3	2	2	2	-	-	-	2	-	-	-	-	-
15ECSC301	2	-	3	-	-	-	-	-	-	-	-	-	-	3
19ECSC302	2	-	-	-	2	-	-	-	-	-	-	-	3	-
17ECSC302	3	1	-	-	1	2	-	-	-	-	-	-	-	-
19ECSP301	3	2	3	-	2	-	-	-	-	-	-	-	-	-
18ECSC301	3	2	2	2	2	-	-	-	-	-	-	-	-	-
17ECSC306	2	-	3	-	2	-	-	-	-	-	-	-	3	-
19ECSP302	3	-	-	-	-	-	-	-	-	-	-	-	2	-
15ECSW301	-	-	3	-	2	-	-	-	2	2	-	-	-	3
20ECSC303	3	2	-	-	-	-	-	-	-	-	-	-	-	-
20ECSC305	3	2	-	-	-	-	-	-	-	-	-	-	-	2
15EHSC301	1	1	-	1	-	-	-	-	-	-	-	-	-	-
18ECSP304	3	-	-	3	3	-	-	-	-	-	-	-	-	3
20ECSP305	2	-	3	-	3	-	-	-	-	-	-	-	-	2
15ECSW302	-	3	3	-	1	-	-	-	3	3	-	2	-	3
20ECSC402	3	-	-	-	-	-	-	-	-	-	-	-	-	-
17ECSC401	3	-	-	-	-	-	-	-	-	-	-	-	3	-
15EHSA401	-	1	-	-	-	1	-	1	1	1	2	-	-	-
20ECSW401	-	3	3	-	3	2	2	-	3	3	2	-	-	3
20ECSW402	-	3	3	-	3	2	2	-	3	3	2	-	-	3

1: Low 2: Medium 3: High "-": No Correlation

Some examples of Blended, collaborative, experiential, and project-based learning (PBL) practices:

To make the learning more engaging and effective several pedagogical initiatives are undertaken. Following are the examples of these initiatives undertaken by the University.

- **Blended learning adaptation**

The urgent imperative to 'move online', caused by the recent Covid-19 pandemic, created a unique challenge to educational institutions and students. The initial crisis response of educational institutions with remote teaching through recorded videos was not appreciated by the students. The Universities had to innovate in designing and organizing instructional activities using digital technologies to facilitate meaningful online learning experiences.

In response to the Covid-19 Pandemic, KLE Tech developed and adopted the online learning model, which brought together the optimum blend of asynchronous (on-demand) and synchronous (live) online delivery to ensure students' effective learning engagement. Education research labels this approach as Bichronous online learning.

- To develop and adopt an online delivery model that ensures effective student engagement in learning.
- Evolve best ways to blend asynchronous and synchronous online delivery modes to gain the advantages of both while reducing the limitation of each.
- To set up appropriate infrastructure and digital platforms to provide seamless access to world-class content and learning experience.

The practice aims to integrate asynchronous and synchronous learning environments to leverage the advantages of each environment to attain instructional goals and learning outcomes. The learning experience combines high-quality digitized video lectures, which are available any time anywhere (asynchronous), and interactive Livestream classes (synchronous) that take the learning to the next level. The model has the following components:

KLE Tech. Bichronous Blended Learning Model adopted during COVID-19 is presented in the figure below.

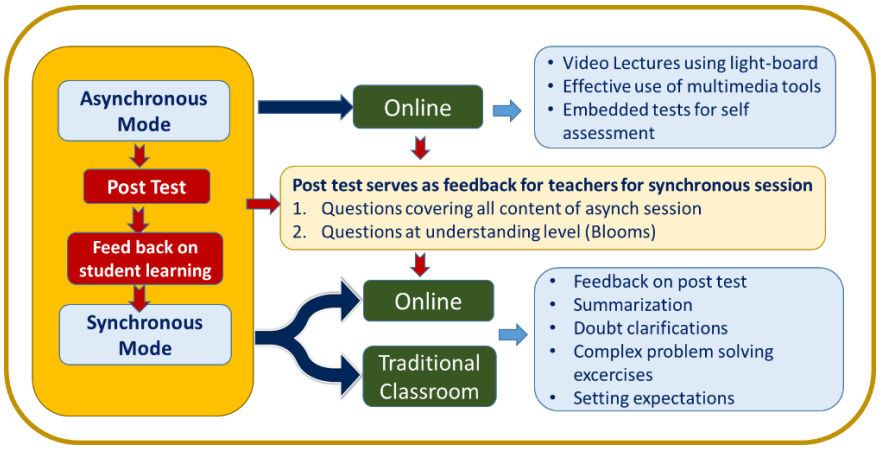

Figure: KLE Tech Blended learning Model

1. Asynchronous mode delivery: The online video lectures are prepared using light-board, which is an innovative way of creating online resources that are closer to the 'real' classroom experience. Light-board lecture videos provide a more 'personal' window into learning for students as facial expressions, gestures, and the subtleties of person-to-person interaction are available at any time and from any location in ways not possible before. The content of each learning module is divided into smaller manageable chunks by grouping conceptually related topics. The resources are hosted on MOODLE platform and can be accessed by students by their desktops, laptops, or mobiles. The digital content for all the courses is being shot at 12 studios put up on the campus.
2. Post-test: At the end of each topic, there will be a well-designed post-test which the students have to take compulsorily. These tests help the students and teachers to comprehend the extent of understanding of the concepts and the content. It will be taken as feedback by the teachers to plan for the ensuing synchronous classes.
3. Synchronous mode delivery: Asynchronous learning is followed by synchronous live sessions where extensive engagement between teachers and students takes place. These sessions focus on clearing the doubts, problem-solving, and team exercises to attain deeper learning outcomes. These sessions were conducted in real-time on the MS-Teams platform.

After the reduction of COVID, the above practice is continued with the difference that the synchronous sessions are running with the physical presence of students in the classrooms.

Looking at the acceptability of the model by the students, it has relevance and huge potential to transform the Indian higher education landscape. India, which is still grappling with accessibility and equity in higher education, can use this model to scale up formal education at an affordable cost in the post-COVID era. The main constraint that can hamper the use of this framework is seamless access to the internet and digital devices. The faculty need to be trained extensively in pedagogical foundations and knowledge of principles needed to design online delivery of courses.

KLE Tech. Blended Learning Model adopted during COVID-19

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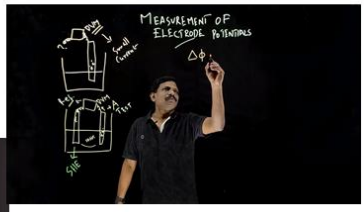
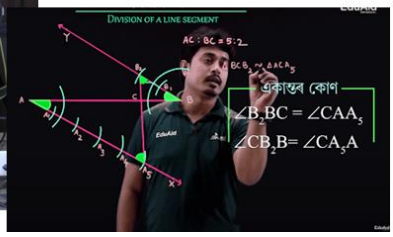
Lightboard Video production setups **14 studios across campus**

- *The Lightboard is a set of lecture recording tools that allow production of high-quality videos where the presenter both **faces the students** and writes on a glass board as they would in a regular class.*

- **Engages learners better by providing greater visual connection with the lecturer.**
- Graphics, visual simulations can be integrated into lectures





- **Project Based Learning:**

Engineering Curriculum for first-year typically has courses related to basic sciences, mathematics, and an introduction to concepts related to programming, electronics, electrical, mechanical, and civil engineering. However, these courses are taught in isolation and have remained as unconnected dots. In order to fill the gap, KLE Technological University started with a unique **project-based learning** course titled Engineering Exploration. Its enduring outcomes are the engineering design process, interdisciplinary nature of engineering problem-solving, and teamwork.

Engineering Exploration is a three-credit course offered for first-year engineering students of the University and characterized by the following unique features:

- It promotes students' learning through exploration and learning by doing.
- It is co-designed and co-taught by a team of faculty members from multidisciplinary engineering disciplines.
- Learning is facilitated by a group of teachers engaged in team teaching
- It follows PBL pedagogy (represented in figure below), focusing on engineering the design process and building mechatronics prototypes.

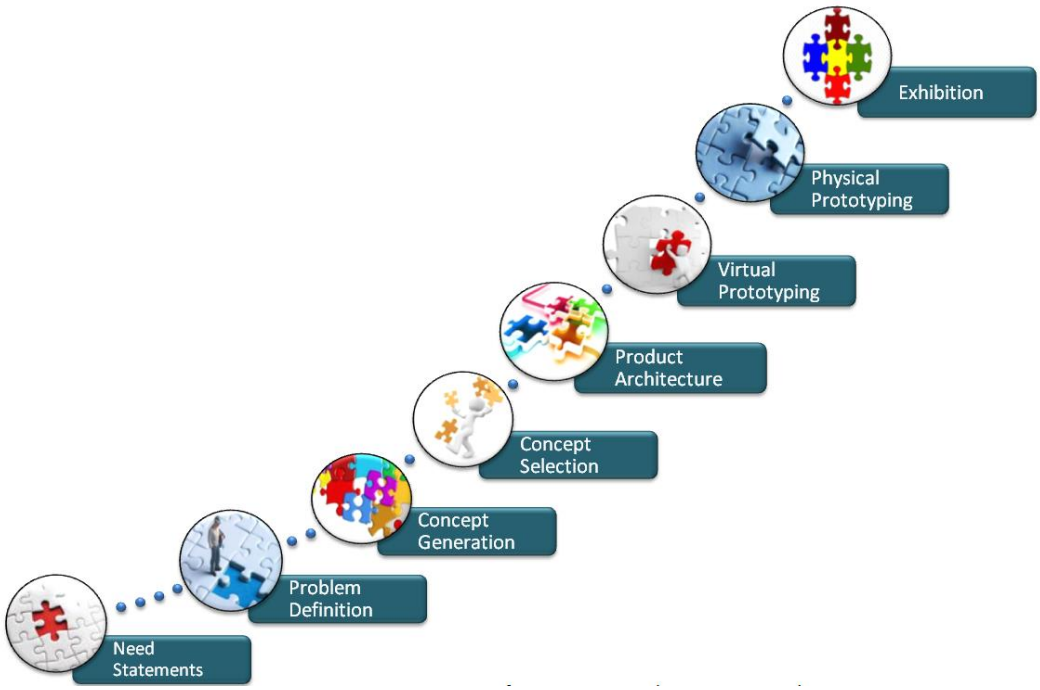


Figure: Engineering Exploration project design process and prototyping

This course has led to several initiatives on the campus that include:

1. MITRA- A peer mentoring program where handpicked set of senior students who have gained expertise in the engineering design process, programming, and prototyping skills, scaffolds first-year students.
2. Project Clinic- A set of faculty provides extra office hours in order to scaffold students.
3. Prayog (Vasant/Sharat) – Celebrating students' success by exhibiting the created project prototypes. The event project and exhibition is a bi-annual event that happens in the spring and fall semesters.


The course is recognized by India Electronics and Semiconductor Association (IESA) as a foundation course for its National ESDM skills Training & Research Academy (NETRA). Through this initiative, 17 institutions in India have adopted the "Engineering Exploration" course in their curriculum.

Undergraduate Minor Programmes:

In addition to their primary area of study, undergraduate Engineering students have the opportunity to study one of the Minors offered by departments/schools/centers in some of the most interesting areas in the profession today. Engineering Minors allow students to gain interdisciplinary experience and exposure to concepts and perspectives that may not be a part of their degree program—thus widening their understanding of the engineering profession and the issues that impact engineers. Upon completion of an Engineering Minor, students will also be better equipped to perform interdisciplinary research. Engineering Minors can generally be completed within a regular degree - some extra courses may be required depending on Minor offering department/school/centre. A separate certificate shall be issued on completion of the Minor discipline requirements. Minor is an additional credential a student will earn if s/he does additional learning of 5 courses in a discipline other than her/his major discipline.

KLE Technological University
Creating Value
Leveraging Knowledge

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School of Mechanical Engineering

Minor Program in Innovation and Product Development (MIPD)

Offered by

Center for Innovation and Product Development (CIPD)

School of Mechanical Engineering

About the Program:

The program introduces students how to take an idea and convert it into a commercially viable product. Contrary to the popular belief that Innovation is for only creative people, innovations can be developed using well defined tools and processes. Product Design follows innovation and finally product realization. Financial aspects of product development, program management and leadership and organizational skills will be imbibed by the students.

Program Outcomes:

At the end of the program, the student should be able to:

- Identify real life problems
- Understand customer needs and analyse
- Generate implementable solutions
- Conduct financial analysis of the product business
- Develop a product program

Requirements for the award of Program: A Student needs to earn a minimum of 18 credits. Also these credits shall be earned before the completion of his/her BE program to become eligible to receive the Minor Program Certificate.

Schedule for Delivery of Courses

Academic batch 2018-22	Jan-May-2020	June-July 2020	Aug-Dec 2020	Jan-May 2021	June-July 2021
	4th Semester	Summer Term-I (4S)	5 Semester	6 Semester	Summer Term-II (6S)
	Product Innovation – 1 (1-1-1)	Product Innovation – 2 (1-1-2)	Organization and Business of Product (1-1-0)	Product Design and Development (1-1-2)	Product Realization (0-0-4)

KLE Technological University is offering following UG Minor programmes:

1. Minor in Entrepreneurship
2. Minor in Electronics
3. Minor in Computer Science & Engineering
4. Minor in Innovation and Product Development
5. Minor in Robotics
6. Minor in Automotive Engineering
7. Minor Advanced Manufacturing and Aerospace Applications
8. Minor in Bio Engineering
9. Minor in Technology and Innovation for Social Transformation (TIST)

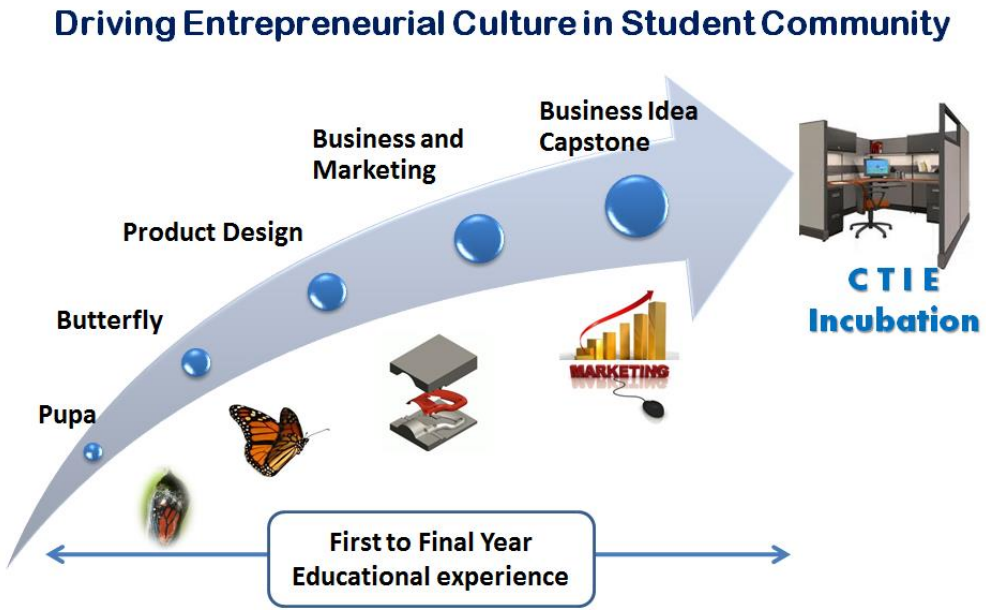
- **Industry Internships:**

  All the Schools/ Departments encourage interested students to take up internships to gain industry exposure at VIII semester. Students spend their entire semester on the industry campus and work on projects given by industry mentors. Assessment is carried out jointly by industry mentor and department guide.

- **Entrepreneurship:**

  A new entrepreneurial and innovation culture is hallmark of the University campus. This cultural movement was catalyzed by 'Centre for Technology Innovation and Entrepreneurship' (CTIE) through formal and informal activities across the campus. In the last five years the University has incubated 38 companies in the campus. Out of these 16 companies are founded by the graduating students. The presence of startups in the campus is a great opportunity for the students to earn the internships and also to carry out the projects which are relevant to the real world. So far Ten start-ups have been established by students from the department.

Centre for Technology Innovation & Entrepreneurship (CTiE)



A few examples from the School of Electronics and Communication are also presented as part of Problem based learning and flipped class room.

- **Problem Based Learning (PBL)**:

  In few of the courses problem based learning approach is used to enhance critical and analytical thinking skills. The curriculum and delivery of elective course Algorithmic Problem Solving was designed and the impact measured through students' performance in competitive programming platforms. Presently PBL approach is also used in the course Problem Solving with Data structures.

- **Flipped Classroom**:

  Some of the fundamental courses are designed to be delivered using flipped mode of course delivery to convert conventional classroom sessions to interactive problem solving sessions. The online content is customized to bring innovations and flexibility in delivery and assessment. It focuses on self-learning outside the classroom. This pedagogy is being implemented in courses Circuit Analysis, Linear Integrated Circuits and CMOS VLSI Circuits.