Innovations by the Faculty in Teaching and Learning

Summary: Teaching Learning Process (TLP)) is the core of any educational institute. At TCET the main focus is on the TLP. Faculties strive to come up with innovation in the teaching-learning process to make sure the stakeholders (students) get maximum benefit out of it. Academic calendar is shared with all the faculties and students before the commencement of the semester. Semester activities are planned in the calendar, which makes it easier for faculties to plan their teaching load. It ensures the effective and efficient conduct of TLP. TCET has adopted Holistic education and has taken all necessary steps to curate the scheme and syllabus in the autonomy to strengthen the performance of students. The TLP policies are decided at the department level by the subject in-charges and are approved by the HoD. This practice helps in maintaining a consistent development of the students, department and the institute.

TCET has adopted innovative strategies, tools and technologies in critical circumstances like Pandemic and have ensured the effective conduct of TLP.

Background: Bringing about improvements in teaching-learning processes is regarded as indispensable to achieve the desired goals and objectives and enrich the overall system of education. Major improvements can be brought about in teaching-learning processes through the implementation of innovative strategies. When modern and innovative strategies are put into practice in the teaching-learning processes, then the faculties and students can carry out their tasks and functions in a manageable and efficient manner. The utilization of various types of latest tools and technologies are regarded as the most significant form of innovations in teaching-learning processes. The members of the educational institutions need to remain updated and augment their skills and abilities in terms of innovative strategies and approaches. The main areas that have been taken into account are, understanding innovations in the teaching-learning processes, innovative tools, and measures to bring about improvements in innovative methods.

Goal: The objective of teaching learning process (TLP) at TCET is to develop knowledge and skills as regulatory needs. The institute has a student centric approach where the student's (stakeholders) requirements are taken into consideration to cater their needs through the innovative TLP. Academic conduct during the semester not only enables the students to clear high stake examinations required to get the university degree but also prepares them with professional knowledge, Employability skills and employment by providing a competitive edge.

Journey: TCET Introduced Holistic education in 2017 which included Activity Based Learning (ABL), Professional Skill Development (PSD), Employability Skill Development (ESD) and Research Based Learning (RBL). With the autonomy in the A.Y. 2019-20, TCET has started from choice-based credit grading system (Holistic development) CBCGS-H and today have CBCGS-HMS where HMS stands for Holistic and Multidisciplinary System. Introduction of Formative assessment (FA) was also included as a part of TLP. Credits were awarded to the HSD activities in the autonomy scheme. Below figure Fig. 5.5.1 shows the Road-map about Curriculum Enhancement.
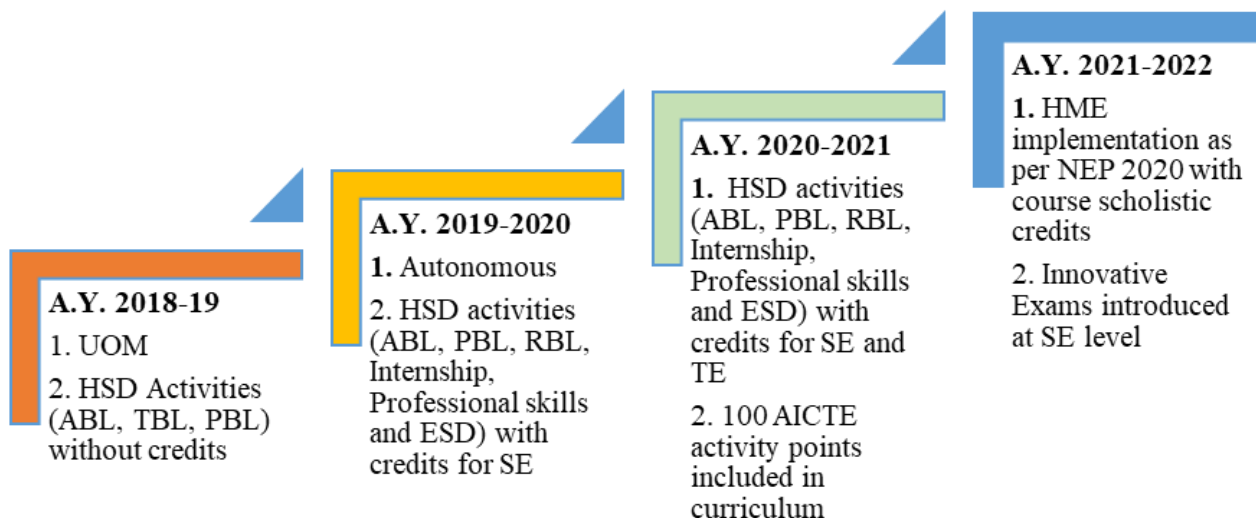
A.Y. 2018-19
1. UOM
2. HSD Activities (ABL, TBL, PBL) without credits

A.Y. 2019-2020
1. Autonomous
2. HSD activities (ABL, PBL, RBL, Internship, Professional skills and ESD) with credits for SE

A.Y. 2020-2021
1. HSD activities (ABL, PBL, RBL, Internship, Professional skills and ESD) with credits for SE and TE
2. 100 AICTE activity points included in curriculum

A.Y. 2021-2022
1. HME implementation as per NEP 2020 with course scholistic credits
2. Innovative Exams introduced at SE level

Fig. 1 Road-map about Curriculum Enhancement

Delivering quality education to students in terms of enhancing knowledge, developing skills, building confidence, and creating a positive impact on their life is the purpose of the teaching-learning process at TCET. Students are motivated to work in an interdisciplinary and multidisciplinary environment to give solutions to complex problems of engineering through their project work or various hackathons. Holistic education is imparted to students in multi-modal phases along with various activities like Project based learning (PBL), Internships and Higher Studies Training (HST) along with the existing activities like ABL, ESD and PSD. Innovative teaching-learning and evaluation methods are adopted to connect the students with academic as well as professional careers.

Usage of Technology in pandemic: The landscape of teaching is changing rapidly & there has been a rise in the use of technology in this sector. The practices in TLP have taken a very new form during the pandemic. Before the pandemic the TLP took place in the traditional classrooms and laboratories. Faculties used to use black-board/white-board for conducting lectures and practical. Students used to get evaluated based on their performance in the exams. During the pandemic the traditional setup of normal classroom teaching was forced to change in online mode.

Keeping the changing environment in mind, faculties have adopted the use of various tools and techniques to make the process of teaching and learning more interactive and effective. As a part of **Blended learning**, use of **Flipped classroom** was adopted by the faculties and was well received by the students. All the subject in-charges have created a resource book, lab manual and notes for their respective subjects. The material is shared with the class through an ERP (the software used by students as well as faculties for attendance and notes sharing primarily), Microsoft Teams and Google Classroom.

Blended Learning is a combination of learning methods that incorporate multiple teaching methodologies which includes eLearning as well as traditional face-to-face learning. A blended learning approach ensures that the student is engaged effectively. The practice of innovations for effective and meaningful teaching and learning is achieved by the faculties through thoughtfully designed experiments for their respective subjects and by opting the use of various pedagogical approaches, technologies, curricular enhancement, course design and organization, and assessments.

Objectives of TLP: TCET follows following objectives for the TLP,

1. To check the regularity and punctuality of the student in the sessions with learning discipline.

·   Achieved using the process of student validation (categorization of students in high, medium, low) and teacher Guardian book.

2.   To achieve the Eligibility of term grant for students.

·   Achieved with the help of attendance, formal, informal and diagnostic assessments throughout the semester through teacher guardian, subject in-charge and class in-charge.

3.   To complete the course in a specified time period by students.

·   This can be achieved with the help of skill development and competency development. Process of continuous evaluation also helps in understanding the progress of the student. With the help of a teacher guardian the learning gaps in the TLP are identified for the students and are conveyed to the responsible person.

Process of TLP (Adequate preparation with the use of appropriate methods):

For each subject, faculty has created a playlist of online video lectures for various topics of the syllabus as per the modules. Along with a playlist, module-wise question bank and interactive presentations are also prepared and shared with the students on a timely basis. The video lectures of the faculty are recorded and are kept on the drive as well as in the YouTube channel of an individual faculty for the future references of the students.

The subject orientation is given to the students at the commencement of the semester by the respective faculty incharge, to give them subject idea, list of Practical and activities that are performed throughout the semester.

For each subject the conduction of **Formative Assessment (FA)** is scheduled at the start of the semester. The Academic Calendar contains the dates related to FAs for each year. Students are given the schedule through Academic Calendar and Individual faculties also share their respective FA schedule with the students. The formative assessments are taken in the form of, Open-book test, quiz (using Google form), test (the questions are known to the students beforehand) etc, as per the schedule for the subject. 3 FAs are scheduled for each subject. These FAs are taken with the help of **Microsoft Teams/Google Forms. Google classrooms** and **Microsoft Teams** are used to create the classes for individual subjects and are also used for sharing the material, FAs and other related instructions to the subjects.

For Value addition in the course, **Guest Lectures** (for eg. In some subjects, Introduction to machine Learning and Management Information System) were arranged. Five domains are identified in the department**.** Specialization courses in Artificial Intelligence and Data Science have been introduced in the curriculum for the benefits of the students.

For the practical performances, the experiment list for an individual subject is prepared well in advance with care and is modified every year at least by 20% understanding the need of variation and innovation. The experiment list is categorized into 4 parts, **Basic** experiments, **Design** experiments, **advanced** experiments and **Case Study/ Mini Project/ Presentation**. **Capstone projects** have also been introduced under Professional Electives. Under each category the experiments are curated. The basic category usually consists of simple 2-3 experiments from the initial module of the subject, the design category usually consists of designing experiments from the rest of the modules and the advanced category has some very difficult experiments to be performed. For the last category of Case study/Mini Project/Presentation, students are asked to form a group of 2-3 within the batch for performing the case study/ Mini Project/Presentation as the subject. For some subjects faculty has

encouraged the students to perform the practical **on simulator / online compilers/mobile editors/ IIT virtual labs (eg.** Database management systems, Computer Graphics using IIT virtual labs, Digital Logic Design and Analysis on CircuitVerse).

The **evaluation** of the practical is done on a weekly basis. The evaluation is done by checking the individual code/program followed by viva. The evaluation is done in 2 cycles for the final marks. For 8 experiments, the first 4 are considered in **cycle 1** and the remaining experiments are considered in **cycle 2**. The average of the cycles is done for the final submission.

Group learning activities: To keep the students focused and inculcate good learning habits among the students, innovative teaching learning techniques are initiated by introducing various group learning activities, technology courses for the subject and by designing subject experiments at different levels.

The concept of **Project Based Learning** (PBL) for implementation of mini projects using the technology learnt under **Professional Skills** (PS) was introduced as a group learning activity. Usually the technology/tools learnt in PS is used to implement in PBL. Introduction of the **Research Based Learning** (RBL) in the curriculum was done to encourage students to take up minor projects in their domain of interest by forming a group. RBL activities are carried out from semester 5 to semester 8. Summer **Internship** is a part of the teaching learning process under the Holistic Student Development (HSD). The activities under HSD are given activity points and credit in the Autonomy for the benefits of the students. The credits are allocated to the students in their final year mark-sheet. Below table Table B.5.5-1 shows the Innovations in Teaching Learning Process during Three cycles of NBA.

Table 1 Innovations in Teaching Learning Process during Three cycles of NBA

Sr. No.	Objectives	Outcomes
NBA cycle 1 **2013 - 2016**	Curriculum Linkage established with industry and professional career.	Students got inputs about current industry trends and skills
	Addition of zero hour for conducting extra lectures	Planning extra lectures helped to cover 100% syllabus
	Extracurricular activities were added in the class timetable	Participation in such activities improved little.
	Practice of Department semester review report at the end of every semester with Strength, Weakness, Opportunities and Threat (SWOT) analysis started	Controlling, monitoring and motivating department activities became easy.
NBA cycle 2	Holistic education - ABL, PBL, TBL, ESD and RBL started	PBL helped applying theory concepts into practice

2016 - 2019		TBL supported knowing new technological trends ESD helped delivering employability skills RBL motivated applying research culture among students and faculty
	Collaborative learning (CL), Self-learning(SL), E-learning (EL) added in timetable	Helped to cultivate learning beyond college hours and lifelong learning.
NBA cycle 3 **2019 - 2022**	CBCGS-HME 2020 scheme adopted where holistic education is credit based	Participation in holistic activates improved after giving them credits Holistic activates shape the multi-faceted character building of students
	Alignment of TLP with NEP 2020 and Calibration with TV 2035 vision	TLP process is aligned with emerging technologies which give confidence to students to solve real time problems in the current scenario.
	Blended education	Successful delivery of TLP during pandemic. Adapting to smart teaching learning style

Innovative methods adopted by faculty members for the teaching learning process are mentioned in the following table Table1

Table 2 Innovative Teaching Techniques

Sr. No.	Innovative Teaching Learning Techniques	Activities	Objective	Outcome
	Use of ICT	Teaching Learning Process (TLP) conduct	To make effective use of ICT for Teaching Learning process before pandemic	· Conduct of TLP with integration of different tools like Smart board, Projectors and Internet connectivity for interactive learning

			and during pandemic	· Conduct of online TLP with use and integration of different online platforms like licensed version of Zoom & M S Team. · Lectures are conducted in online mode using online platforms like the licensed Zoom and Microsoft (MS) team. · For some subjects faculty has encouraged the students to perform the practical on simulator/ online compilers/mobile editors/IIT virtual labs (e.g. Database management systems, Computer Graphics using IIT virtual laboratory, Digital Logic Design on virtual laboratory). · Pen tablets, headsets and cameras are used to enhance course delivery.
		Google Classroom creation E-resource sharing	To effectively share resources with students for knowledge enhancement	· Google Classrooms to distribute and grade subject assignments in a paperless way. E-Platform to provide study material · Students are assigned with Gsuit Ids, teaching materials are shared through Google classrooms (GCR). Assignments are posted and accessed in GCR. Quizzes conducted through Google forms and MS forms. · Along with a playlist, module-wise question bank and interactive presentations are also prepared and shared with the students on a timely basis. · All the subject incharges have created a resource book, lab manual and notes for their respective subjects. The material is shared with the class through an ERP (the software used by students as well as faculties for attendance and notes sharing primarily), Microsoft Teams and Google Classroom. · E-journals are available in central library
2	**Instruction delivery &**	Co-teaching with industry	To enhance students learning	· Industry experts from each subject are invited to conduct sessions for

		experts	through industry experts	encouraging students and creating awareness about latest trends and techniques related to the subject.
Instruction method		Blended learning	To provide students with ease of teaching learning process through pandemic	· Blended Learning is a combination of learning methods that incorporate multiple teaching methodologies which includes e-learning as well as traditional face-to-face learning. A blended learning approach ensures that the student is engaged effectively.
		Flipped classroom	To enable students to have an active learning environment	· The flipped classroom inverts the traditional learning experience. Lectures are shared outside of class time for individual review as homework, and classroom time is reserved for class discussion and interactive projects. This helps in making the classroom an active learning environment & enables students to learn at their own pace.
		Design based and group activity experiments.	To enhance student's knowledge through collaborative learning	· The experiment list is categorized into 4 parts, Basic experiments, Design experiments, advanced experiments and Case Study/ Mini Project/ Presentation. Capstone projects have also been introduced under Professional Electives. For the last category of Case study/Mini Project/Presentation students are asked to form a group of 2-3 within the batch for performing the case study/ Mini Project/Presentation as the subject. · To keep the students focused and inculcate good learning habits among the students, Innovative teaching learning techniques are initiated by introducing various **group learning** activities, technology courses for the subject and by designing subject experiments at different levels.
		Think Pair Share activity for classroom teaching.	To enable students to learn problem solving through sharing with peers	· In the Think Pair Share method students work together to solve a problem or answer a question about an assigned reading. Students think individually about a topic or answer to a question; or share ideas

				with classmates after discussing with a partner maximizes participation, focuses attention and engages students in understanding the concept learned.
		Role Play Based Teaching	To provide students with opportunities to learn and develop skills in purposeful ways	· Role play based teaching is used to explore realistic situations by interacting with other people in a managed way in order to develop experience and trial different strategies in a supported environment. Depending on the intention of the activity, students are playing a role similar to their own (or their likely one in the future) or play the opposite part of the conversation or interaction. Both options provide the possibility of significant learning, with the former allowing experience to be gained and the latter encouraging the student to develop an understanding of the situation from the 'opposite' point of view of the concept learned.
		Brainstorming	To provide diverse perspectives for a topic	· The subject incharges begins a brainstorming session by posing a question or a problem, or by introducing a topic. Students then express possible answers, relevant solutions and ideas.
		To create web pages and YouTube channel for communications with students	To effectively share resources with students for knowledge enhancement	· Faculty have created web pages for sharing resources with students like modules, PPTs, Experiment procedure, etc. · For each subject, faculty has created a playlist of online video lectures for various topics of the syllabus as per the modules. · The video lectures of the faculty are recorded and are kept on the drive as well as in the YouTube channel of an individual faculty for the future references of the students.

| 3. | **Assessment & Evaluation** | Formative assessment

 Innovative exam for SE.

 Use of online tool for evaluation | To get better understanding of the students learning through continuous evaluation | · For each subject the conduction of Formative Assessment (FA) is scheduled at the start of the semester. The Academic Calendar contains the dates related to Formative Assessments for each year. Students are given the schedule through Academic calendar and individual faculties also share their respective Formative Assessment schedule with the students.

 · Innovative examination is introduced in FE and SE to develop student's skill towards innovations in concepts learned and applications of the concepts and subjects.

 · Google quizzes, Mentimeter and mind map are used to evaluate students understanding for topic and subjects

 · The evaluation of the practical is done on a weekly basis. The evaluation is done by checking the individual code/program followed by viva. The evaluation is done in 2 cycles for the final marks. For 10 experiments the first 5 are considered in cycle I and the remaining experiments are considered in cycle 2. The average of the cycles is done for the final submission. |
| 4. | **Inclusive classroom** | Activity Based Learning (ABL),

 Project based Learning (PBL),

 Research Based Learning (RBL),

 Programming Skills (PS),

 Internship,

 Employability Skill Development(ESD), | To enhance multidisciplinary learning for overall development of the students | · In Activity Based Learning (ABL) students are encouraged to participate actively in different activities either individually or in a group with their own learning experience through practical activities. ABL activities are conducted from semester 1 to semester 4.

 · The concept of Project Based Learning (PBL) for implementation of mini projects using the technology learnt under Professional Skills (PS) was introduced as a group learning activity, usually the technology/tools learnt in PS is used to implement in PBL Introduction of the Research Based Learning (RBL) in the curriculum was done to encourage students to take up minor projects in the domain of interest by forming a group. RBL activities are carried out from semester 5 to semester 8. |

		Specialization courses Competitive Examination		· Internship is conducted to strengthen technical knowledge of the students in various domains. Domains are identified as per student's interest and curriculum. · Employability Skill Development (ESD) is implemented to develop student's skill keeping industry requirements. External Industry experts are conducting training on identified skills. · If students register for specialization courses, they are learning specialization courses from NPTEL and Coursera. Extra credits will be given to students for completion of the courses. · GATE training is conducted for interested students.

Conclusion: *Innovation in TLP leads to fruitful engagement of students. It can focus on student's development with the help of various pedagogical strategies. Increased interaction between the students and faculties is the major outcome of innovations in TLP. Faculties are also explored to latest tools and technologies in the market and are upgraded.*