Designing Guidelines for Alternative Assessment Tools (AAT)

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. The AAT may include:

1. Tutorial hours/classes
2. Seminars
3. Assignments
4. Technical quiz
5. Term paper
6. Open ended experiments
7. METE Expo (Modelling and Experimental Tools in Engineering)
8. Concept video
9. Partial reproduction of research work
10. Oral presentation of research work
11. Developing a generic tool-box for problem solving
12. MOOC Certification
13. Report based on participation in
    - create-a-thon,
    - makea-thon,
    - code-a-thon,
    - hack-a-thon

1. Tutorial hours/Classes

Whether in-person or online, facilitating tutorials is an opportunity to work closely with students and understand where they are in their learning. Tutorials will run differently depending on course/subject of study. The most common tutorial types are:

- **Discussion-based tutorials:** these tutorials focus on a deeper exploration of course content through discussions and debates.
- **Problem-solving tutorials:** these tutorials focus on problem solving processes and quantitative reasoning.
- **Review and Q&A tutorials:** in these tutorials, students ask questions about the course content, question bank, assignments, review key course content in preparation for tests or exams, and consolidate their learning.

2. Seminars

Seminars usually follow the previous lecture on the topic, and it is where the faculty will go more into detail on the topics discussed and will break it down to understand the concepts better. Depending on course, there might have two to three seminars per week.

Usually, in seminars the students may be permitted to do some group work, practical tasks, ask any questions and raise concerns if something in the lecture was difficult to understand or unclear. Seminars are usually situated in smaller rooms, with only people specifically on your course. They are usually around 20 people per class but this does vary course to course and is not set.

3. Assignments

As calculations and critical thinking are important, engineering assignments go beyond technical skills. Paying extra attention to engineering assignment writing, improves the ability to communicate complex ideas clearly and concisely – a must-have skill for engineers who must collaborate effectively, document their work professionally, and present findings.

Here are 5 most common types of engineering assignments that can be thought about:

- **Solving Problems**
  These assignments challenge students to apply engineering principles and scientific knowledge to analyse and solve real-world or hypothetical problems. They may involve calculations, simulations, or designing solutions that meet specific criteria.

- **Design Projects**
  In these assignments, students take on the role of engineers and design a product, system, or process. This could involve creating detailed drawings, using computer-aided design (CAD) software, or building a prototype.

- **Research and Analysis**
  Engineering is a research-driven field, and these assignments expose students to gathering data, conducting experiments, analysing results, and conduct literature survey. Engineering students will face writing research papers, presenting findings, or drawing conclusions based on data.

- **Computer Simulations**
  Modern engineering heavily relies on computer modelling and simulation. These assignments involve using software to create virtual models of systems or processes to analyse their behaviour and performance.

- **Technical Writing and Communication**
  Effective communication is essential for engineers. These assignments focus on developing writing skills, such as writing technical reports, proposals, or user manuals. Students may also be required to give presentations or participate in technical discussions.

4. Technical Quiz

Technical quiz is the written test that requires the learner to select the correct answer from among one or more options or complete statements. This test includes both textual and numerical question types including simple calculations, MCQs, fill-in-the-blanks questions and short essay questions.

It is useful to assess the basics or low order' thinking skills of students to ensure a firm foundation and knowledge. Creating a technical quiz requires careful planning to ensure that it accurately assesses knowledge.

The factors to be considered in designing and framing of technical quiz Questions.

Designing stems

1. Each question is made based on topic learning outcome for the course
2. Good stem means, the students would be able to answer the question without looking at the options.
3. Put all relevant material in the stem
4. Eliminate excessive wording and irrelevant information from the stem
5. Avoid complex questions or answers which feed ambiguity.
6. The stem should challenge, but not be too difficult.
7. Use a single, clearly stated problem or question in stem

Designing options

1. Limit the number of options between three and five is good, but having four options is good practice.
2. Avoid use of "none of the above" or "all of the above" options which result in a negative effect on students' performance.
3. Make sure there is only one best answer
4. Make the choices grammatically consistent with the stem
5. Randomly distribute the correct response.

5. Term Paper

Engineering education is not only about learning from tons of books: It should also, ideally, foster critical thinking, teach you how to argue your points effectively, and help you develop research skills. And all three of these include in a term paper.

It is important to note that there is a difference between a research paper and a term paper. Their main difference is the time at which they are assigned to the college students. A term paper should be submitted at the end of the semester while a research paper can be assigned at any time during the semester and the time to submit is not specifically at the end of the semester.

A term paper is a longer type of research-based homework on a particular topic either, selected by the student or assigned by the professor. Regardless of whether selected by the student or are assigned one, term papers mostly have the same goal. Term papers range from 15 to 25 pages because any less is considered lazy and any more is too much for any professor to read.

Term Paper Format

Each term paper should follow a relatively familiar structure and way of arguing your points. Let's start with the basics:

- **Cover page.** This is where your title goes (centred, bolded, pt24 ideally). The cover page should also list your personal details, such as name, address, email, student ID number, phone number, and the department for which you are writing your term paper.
- **Table of contents.** Readers need to know what to expect!
- **Abstract.** This one page long contains the purpose of the study, the reason behind the research question and why you are interested in that topic. An example; if your term paper is about finding out a relation between two ideas, the abstract should describe this using the fewest words.
- **Introduction.** This is a more elaborate version of your project outline. You should specify what the paper is dealing with, what theoretical framework you're using, and what your hypothesis is.

- **The body of the paper.** Your case studies, experiments, and results should be explored and described in detail. General parts of the body of the paper include:
  - **Theoretical framing.** Explain which theories or ideas you're using.
  - **Methodology.** This is mostly present in scientific papers where you must explain what methods will guide your study (i.e. experiments).
  - **Analysis.** Close readings, experiments, data surveys – whatever your project is doing, it should be doing it here.
  - **Discussion.** Feel free to start interpreting your results in this section. A great paper does not simply list data – it compares and contrasts. You must be able to draw conclusions about what your analysis has shown you. Results as expected? Hypothesis confirmed. Results not ideal? There's something to write about. Consider why something turned out differently and what that means for future studies.
  - **Optional:** Pitfalls and future improvements. You could address possible pitfalls or blind spots in your study and suggest how they can be improved upon in the future. You can also talk about what lines of research your project can inspire.
- **Conclusion.** Briefly summarise the key points of research and main results. If you haven't already devoted a separate section of the paper to this, you can also write about indications for future research in your conclusion.

6. Open Ended Experiments

Open Ended Experiments (OEE) is a suitable method to measure student achievement in the practical skills and the psychomotor ability. It is also closely related to students' perception of their communication achievement throughout the course.

Integration of open ended experiments in teaching and learning approach is required, due to increasing use of emergent technologies in research and industry. As a result students could relate and use the knowledge learnt in each laboratory to complete the task.

Performing open ended experiments for laboratory courses gives freedom to develop their own experiments, instead of merely following the already set guidelines from a laboratory manual or elsewhere. It will create the students to think critically and also out of the box. The students here have to devise their own strategies and back them with explanations, theory and logical justification.

Implementing open ended experiments, increase the independent learning amongst students by giving them a platform to be innovative and creative in designing and executing their own experiments.

Open ended experiments are exploratory research activities designed without a predetermined conclusion or specific hypothesis to be tested. Unlike traditional experiments, where the goal is to confirm or disprove a hypothesis, open-ended experiments aim to explore possibilities, generate new ideas, or understand phenomena more broadly.

To effectively implement OEE, the faculty needs to provide a list of innovative and creative OEE experiments. These should be designed and executed in a way that fully engages and prepares students.

7. METE Expo (Modelling and Experimental Tools in Engineering)

Good engineering are required to involve in solving the challenging ideas go beyond the capabilities of today's technology by modelling and use of modern engineering tools.

Participation in this practical program, allows students to develop strong creative design capabilities beside engineering expertise. Here, You won't just apply your knowledge to solve problems. You'll become a creative designer who can step back and question why a problem exists and discover users that have been overlooked.

- **From pitches to portfolios**
  In tutorial-style sessions, faculty encourage you to think and develop as an independent designer, with pitches, presentations and portfolios to put your skills to the test. You'll identify and explore a design problem that interests you.

METE expo is the Engineering Design Show conducted each year in March/April.

8. Concept Video

For an engineering student, research and presentation become an integral part. Selecting for presentation by identifying concept oriented topics in the course of study by bringing the best, searching for something new, and presenting the same, is especially important. During the presentation, graphical communication of content is as important as physical or verbal.

Finding the best topics to research and presenting the same can bring new opportunities for student learning. For example, here are some interesting concept-oriented topics (general):

1. Storage area network for use is creating multiple data points and improving data security.
2. Thermal & Infrared Imaging Technology, its applications in industries, surveillance, construction, etc.
3. Traditional and 3D modelling used in films, computer graphics, gaming, interior design etc.
4. Aeronautical Communications for sharing data between aircraft and control centers. Communications such as aircraft-to-ground, aircraft-to-aircraft, and aircraft-to-satellite.
5. Performance Evaluation & EMI / EMC Testing of Energy Meter
6. Forming cheap and efficient low energy efficiency wireless network.
7. In contrast to object-oriented programming, how agent-oriented programming focuses on the construction of software.
8. 3D image technique and multimedia applications
9. Compressed Air Car - A car that can run not on any fuel, not on gasoline, but on air.
10. How Register Transfer Level (RTL) debugging can help find errors, and a need for the debugging to be automated when designs became complex.

9. Partial reproduction and oral presentation of research work

Students as researchers, can take place within and beyond the curriculum to develop student knowledge and understanding and in some cases contribute to the broader knowledge base of their discipline when research is made as an integral part of learning.

This help students to get the opportunity to understand and engage in research being conducted by IARE faculty in engineering who are about to embark upon some academic research, and for more experienced faculty who wish to refresh and refine their approaches to research.

Students ideally need regular opportunities to learn about the institution's research, as well as other research relevant to their studies. They may, for example, become affiliated to research groups, or investigate the work of one researcher in depth.

Through engaging with 'real world' research studies, students can be encouraged to start to formulate their own research questions, and are empowered to explore and critique what might be described as the edge of knowledge in their branch(s) of study..

10. Developing a generic tool-box for problem solving

Problems come in all sizes, shapes, and colors. There is no single or simple step-by-step process guaranteeing us we will solve every problem we encounter. We are faced instead with the requirement to configure or adapt our problem solving processes to fit the problem at hand.

This amounts to recommending that you reinvent the wheel. Be that as it may, the point is that you simply cannot pick up someone else's conceptual tools and make immediate use of them. A certain amount of adaptation is unavoidable.

As a problem solver, you must develop your own system for solving problems and designing a Solution. You have to develop a scheme whereby you can tell if a given problem solving tool is useful or not and put it to use accordingly.

If we don't want something that already exists, our goal is typically one of eliminating it. If we want something that doesn't exist, our goal is ordinarily one of achieving it.

Ultimately, the aim of problem solving is action. To engage in problem solving is to search for a solution. To actually solve a problem is to implement the solution that has been found and demonstrate that it works. Solving problems requires intervention as well as investigation.

The bases to be covered or tasks that typically need tending to in the course of solving a problem are:

1. Defining the problem state.
2. Specifying the solved state.
3. Modelling the structure of the problem.
4. Finding and fixing the "cause" of the problem.
5. Engineering a solution.
6. Settling on a course of action.
7. Reconciling restraints and constraints.
8. Obtaining support and consensus.
9. Preparing plans and schedules.
10. Taking action.
11. Assessing its effects and consequences.
12. Adjusting future actions as required.

The Logic for covering the bases to develop your own system for problems solving

1. Figuring Out How to Make the Required Changes
2. Figuring Out What to Change - Identifying Change Targets and Change Goals
3. Designing a Solution
4. The Goal: Finding Better Solutions Faster

11. MOOC Certification

A massive open online course (MOOC) is a typically web-based modern e-learning education that was initiated for large numbers of geographically dispersed students. These courses often

offer a certification, enhance employment opportunities or further studies. A typical MOOC lasts eight to twelve weeks.

Faculty can integrate MOOCs in traditionally taught courses, leading to waver of AAT component. This is applicable, upon production of certificate issued by Indian main players, SWAYAM and NPTEL, initiated by Government of India.

SWAYAM: Stands for Study Webs of Active Learning for Young Aspiring Minds. It is an India Chapter of Massive Open Online Courses, indigenously developed IT platform, initiated by Government of India, which is instrumental for self-actualization providing opportunities for a life-long learning.

NPTEL: is an acronym for National Programme on Technology Enhanced Learning which is an initiative by seven Indian Institutes of Technology (IIT Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras and Roorkee) and Indian Institute of Science (IISc) for creating online course contents in engineering and science.

12. Report based on participation in

- Hackathon
- Code-a-thon
- Create-a-thon
- Make-a-thon

HACKATHON

Participation in hackathon drive sustained innovation and address pressing real-life business problems and social issues. A hackathon is typically a time-bound competitive event where participants collaborate to build proofs of concept and minimum viable products for a specific pre-defined problem or to innovate.

Over 80% of Fortune 100 companies conduct hackathons to drive innovation. More than 50% of the hackathons are recurring events, indicating that they are a reliable tool for sustained innovation.

Internal Hackathon:

In this type of hackathon, the first step will be idea submission. The event which could be a hackfest for 24 to 48 days or a two-phase hackathon where students across all years / branches submit their ideas via an idea management platform. This phase could last between 2 and 4 weeks. In the second phase, an offline event could be held on Day 15 or 30 of the campaign where chosen ideas are translated into prototypes. Following the presentation and judging, the winners are announced and praised.

External Hackathon

In this type of hackathons, a company engages people within and outside the organization. The invites are often influenced by the themes and goals that are set.

CODE-A-THON:

Codeathon is a 24 hour challenge wherein a team of participants compete to find a solution to a real world problem. A Team of 1 - 3 members are allowed to compete in the event.

CODEATHON = CODING + HACKATHON, as the name suggests help the student developers to level up their skills in coding and help the society to solve their problems using Coding.

CREATE-A-THON

Createathon is an initiative for "Social Responsibility" organized to promote creative solutions to identified challenges. The competition aims to build a culture of innovation in the field of community service. It provides participants with the opportunity to learn the best practices in creating innovative community initiatives, and the opportunity to present, develop, and implement their ideas.

With only 24 hours on the clock, students work in teams to create the best solutions for the identified challenges.

MAKE-A-THON

A Make-a-thon provides a platform for students to immerse themselves in hands-on activities. It not only encourages creative thinking and teamwork but also empowers participants to address meaningful challenges and work on innovative projects.

From first year to final year, students work together to come up with inspiring and innovative prototypes, which could go on to be tomorrow's cutting-edge technology. The Make-a-thon, gives students an opportunity to work in multidisciplinary teams, to apply the theoretical knowledge from their courses and to solve industry relevant, real-world problems.

After 24 hours of high-speed innovation, teams presented to judges. Judging criteria includes creativity, business value, innovation, and functionality.