INSTITUTE OF AERONAUTICAL ENGINEERING

HANDBOOK

for

ENGINEERING DESIGN AND DEVELOPMENT PROJECTS

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1. INTRODUCTION & PURPOSE

Introduction

The Engineering Design and Development Project (EDDP) is a core component of the curriculum across all branches at the Institute. It is designed as an experiential engineering innovation and prototype development journey that enables students to integrate and apply the technical knowledge, analytical skills, and problem-solving abilities developed throughout their academic program to address real-world or research-oriented engineering problems. The EDDP provides students with hands-on experience in identifying problems, developing innovative solutions, designing and building prototypes, and validating their performance with exposure to Technology Readiness Levels (TRLs) and the engineering innovation and development process.

The project spans one or more academic semesters and culminates in a working prototype or system, accompanied by a comprehensive technical report and a formal presentation before a panel of evaluators.

It also meets program outcomes and accreditation requirements, with the EDDP mapped to specific Program Outcomes (POs), Program Specific Outcomes (PSOs), and relevant Sustainable Development Goals (SDGs) ensuring that the project experience contributes measurably to the attainment of graduate attributes. Finally, it prepares students for industry and higher studies: the rigor of end-to-end project execution — from proposal to final deliverable — equips students with the readiness expected by employers and graduate programs alike.

2. OBJECTIVES

I Apply the knowledge and competencies acquired throughout the curriculum to identify, formulate, and systematically address complex, open-ended engineering problems.
II Engage in the end-to-end engineering design cycle, including the identification of problems, analysis of requirements, design formulation, implementation, and validation through testing.
III Develop skills in technical writing, documentation, and professional presentation.
IV Encourage innovation, teamwork, and independent problem-solving.
V Align project outcomes with Program Outcomes (POs), Program Specific Outcomes (PSOs), and relevant Sustainable Development Goals (SDGs).

3. COURSE FRAMEWORK

This project work isn't two disconnected courses — it's one continuous journey split across two semesters, each building on the other.

The Engineering Design Project and Engineering Development Project are integral components of the curriculum, designed to provide students with hands-on experience in solving real-world engineering problems through a progressive Technology Readiness Level (TRL) framework. The Engineering Design Project focuses on advancing innovative ideas from TRL 1–4, encompassing problem identification, literature review, concept formulation, technology development, design, and prototype validation. The Engineering Development Project subsequently advances the selected solution through TRL 5–7, focusing on prototype refinement, system development, integration, testing, validation, and demonstration in relevant operational environments.

Throughout this design-to-development journey, students are encouraged to apply the knowledge and skills (WKs) acquired through their academic coursework to practical engineering challenges while fostering creativity, innovation, and sustainable engineering practices. Beyond technical competency, these project courses cultivate essential professional skills expected of modern engineers, including teamwork, project planning, technical documentation, effective communication, ethical decision-making, problem-solving, testing and performance evaluation, and presentation skills.

Table 1 presents the semester-wise framework of the Engineering Design Project and Engineering Development Project. It highlights the progression from problem identification and prototype development in the V Semester to system development, integration, and deployment in the VI Semester.

Table 1: Semester-Wise Framework of Engineering Design and Development Projects

Parameter	Engineering Design Project	Engineering Development Project
Semester	V Semester	VI Semester
Methodology	Learn-by-doing	Design-to-implementation
Learning Framework	Project-Based Learning (PBL)	Research-Based Learning (RBL)
Primary Focus	Problem identification, research, design & prototyping	System design, development, integration & deployment
Outcomes	A working model / prototype + project report	A fully implemented, functioning system + project report

4. TRACKS AND THEMES

To provide students with structured yet flexible avenues for innovation, the EDDP is organized under a set of defined tracks and themes. Students, in consultation with their project guides, select a track that aligns with their branch, interests, and career aspirations, and then identify a specific theme or problem area within it.

Tracks

The EDDP offers students six distinct tracks to guide their project selection, spanning from discipline-specific work to interdisciplinary and industry-linked initiatives. These tracks range from Core Domain projects grounded in a student's own branch, to Interdisciplinary work spanning multiple engineering fields, to Emerging Technologies projects. Additional tracks include Industry-Sponsored projects guided by real-world industry problems, Societal and Community Impact projects aligned with the UN Sustainable Development Goals, and Research and Innovation projects aimed at original contributions with potential for publication or patent. The Table 2 below summarizes each track and its scope.

Table 2: Engineering Design Project Tracks and Scope

S.No	Track	Scope
1	Core Domain	Projects rooted in the fundamental principles and standard practices of the student's own branch of engineering, addressing well-established problems within that discipline.
2	Interdisciplinary	Projects that integrate concepts and tools from two or more engineering disciplines to solve problems that do not fit neatly within a single domain.
3	Emerging Technologies	Projects cantered on contemporary and rapidly evolving technologies such as Artificial Intelligence and Machine Learning, IoT, Robotics, Data Science, Cybersecurity, and Sustainable Engineering.
4	Industry-Sponsored	Projects proposed or co-guided by industry partners, addressing real-world problems of relevance to a sponsoring organization
5	Societal and Community Impact	Projects aimed at addressing local, regional, or national challenges with direct benefit to society, community welfare, or sustainability,

		often aligned with the United Nations Sustainable Development Goals (SDGs).
6	Research and Innovation	Projects oriented toward original research, novel algorithms, or experimental methods, typically leading to a potential publication or patent.

Themes

The Table 3 below consolidates twelve specialization areas spanning AI/ML, data science, IoT, cybersecurity, and software development alongside core engineering disciplines such as aeronautical, mechanical, civil, electrical, and electronics systems. It also includes two cross-cutting areas Societal/Sustainability-linked and Industry-Sponsored that extend project scope toward social impact and real-world industry collaboration. Each specialization is paired with its indicative focus areas to help guide students toward relevant, well-defined project themes.

Table 3: Specialization and Indicative Focus Areas for Engineering Design Projects

Specialization	Indicative Focus Areas
Artificial Intelligence & Machine Learning	Deep learning, computer vision, NLP, generative models, explainable AI
Data Science & Analytics	Big data pipelines, predictive analytics, visualization
IoT & Embedded Systems	Edge AI, sensor networks, smart devices
Cybersecurity	Threat detection, secure systems, applied cryptography
Software Systems & Web/App Development	Full-stack platforms, cloud-native systems, mobile applications
Aeronautical / Aerospace Design	UAV/drone design, propulsion, structures, aerodynamics
Mechanical Systems & Design	CAD/CAM, robotics, thermal systems, additive manufacturing
Civil & Structural Engineering	Structural design, smart materials, sustainable construction
Electrical & Power Systems	Renewable energy, power electronics, smart grid
Electronics & Communication Systems	Embedded hardware, signal processing, RF/communication systems
Societal / Sustainability-linked	Healthcare, agriculture, education, environment (SDG-aligned)
Industry-Sponsored	Problem statements provided by industry partners

5. TEAM FORMATION

The EDDP is undertaken in teams to reflect the collaborative nature of real-world engineering practice. Team formation is governed by the following guidelines:

- Each project team shall consist of either an individual student or a group of a maximum of 3 students, unless otherwise specified by the department for a given academic year**.**
- Wherever possible, teams should be formed to bring together members with complementary skills and interests, enabling a more effective distribution of project responsibilities.
- Teams are typically formed within the same branch, though interdisciplinary teams involving students from different branches may be permitted or encouraged, particularly for projects under the Interdisciplinary Track.
- Students are generally allowed to form their own teams; however, the Departmental Project Committee reserves the right to reconstitute teams to ensure balanced group sizes and academic fairness.
- Upon formation, each team must designate a Team Lead responsible for coordination and communication with the project guide, while ensuring that all members contribute meaningfully across the phases of the project.

- Each section is assigned three faculty mentors one from the department and two from the IIC who mentor the team through problem formulation, design, implementation, and evaluation.
- Co-guidance with an external/industry mentor is permitted for sponsored projects, with prior HoD approval.
- Team formation, along with the selection of track, theme, and project guide, must be finalized and submitted to the department within the timeline specified in the project schedule.
- Once finalized, teams are expected to remain constant for the duration of the project. Any change in team composition requires written justification and approval from the Departmental Project Committee.

6. PROJECT TIMELINE, PHASES AND DELIVERABLES

This Table 4 outlines the seven-phase progression of the Engineering Design Project, from problem identification through final evaluation, detailing the key activities, deliverables, and indicative timeline associated with each phase across a standard 16-week semester.

Table 4: Phase-wise Schedule and Deliverables

Phase	Title	Description	Key Deliverable	Weeks
Phase 1	Problem Identification and Team Formation	Students form teams, select a track and theme, and identify a suitable problem statement in consultation with their project guide.	Preliminary project proposal (for departmental approval)	Week 1–2
Phase 2	Literature Review and Requirement Analysis	Teams review existing literature, technologies, and solutions relevant to their chosen problem, and translate their understanding into clear functional and non-functional requirements.	Literature Survey and Requirement Specification document	Week 3–4
Phase 3	Design and Planning	Teams develop the system architecture, design methodology, and implementation plan, including selection of tools, technologies, and datasets where applicable.	Design Document and project work plan (First Review)	Week 5–6
Phase 4	Implementation (Stage I)	Teams begin development of the core components of their solution, focusing on foundational modules, algorithms, or subsystems.	Functional prototype or partial implementation (Second Review)	Week 7–9
Phase 5	Implementation (Stage II) and Testing	Teams complete the remaining implementation, integrate all components, and conduct systematic testing and validation against the defined requirements.	Working end-to-end prototype (Third Review)	Week 10–12
Phase 6	Documentation and Report Preparation	Teams consolidate their work into a comprehensive project report, following the prescribed format, and prepare supporting materials such as presentation slides and demonstration content.	Project report, presentation slides, demonstration content	Week 13–14
Phase 7	Final Evaluation and Presentation	Teams present their completed project before a panel of evaluators, including a live demonstration, followed by a viva-voce examination.	Final grading based on complete body of work	Week 15–16

7. DOCUMENTATION REQUIREMENTS

This section outlines the complete set of deliverables spanning documentation, technical artifacts, and presentation material that each team is required to submit over the course of the EDDP.

Documentation

- Project Proposal Document (Track, Theme/Domain, Abstract, Goals & Objectives, SDG/PO/WK/TRL mapping, Tools & Technologies, Expected Outcomes, Base Papers)
- Literature Survey Report
- Design Document (architecture diagrams, data flow, module descriptions)
- Final Project Report (per formatting guidelines in Section 9)

Technical Artifacts

- Working source code with version-controlled repository
- README with setup and execution instructions
- Test cases / evaluation results / performance benchmarks

Presentation Material

- Review slide decks (Reviews 1, 2, 3, and Final Viva)
- 24 × 36 inches (61 × 91 cm)-size project poster for the final exhibition
- Short demo video (5–10 minutes) of the working system

8. FINAL OUTCOME OF THE PROJECT

Upon successful completion of the Engineering Design Project, each team is expected to deliver a working, validated solution to the problem they have addressed, along with comprehensive documentation of the process undertaken to arrive at it. Specifically, the final outcome comprises the following:

- **A Functional Prototype or System**: A working implementation of the proposed solution, tested and validated against the requirements defined at the outset of the project, demonstrating that the design objectives have been met.
- **A Comprehensive Final Report**: A complete technical report documenting the problem statement, literature review, design methodology, implementation details, testing outcomes, and conclusions, prepared in the prescribed institutional format.
- **Demonstrated Attainment of Program Outcomes**: Evidence, through the project work and its documentation, of the attainment of the mapped Program Outcomes (POs) and Program Specific Outcomes (PSOs), as required for accreditation purposes.
- **A Formal Presentation and Viva-Voce**: A live demonstration and viva-voce of the project before a panel of evaluators, reflecting the team's technical understanding and ability to communicate their work effectively.
- **Potential for Further Value Creation**: Where applicable, outcomes that extend beyond academic completion, such as a research publication, a filed patent, a proof-of-concept for further development, or a solution with potential for incubation, industry adoption, or societal impact.
- **Individual and Team Competency Development**: Beyond the tangible deliverable, each student is expected to emerge with strengthened technical expertise, design thinking, teamwork, and professional communication skills applicable to their future academic or industry pursuits

Value-Added Outcomes

Teams are encouraged, where applicable, to pursue outcomes beyond the baseline deliverable, which strengthen the project's impact and the students' portfolios:

- A indexed conference/peer reviewed Journal publication
- A provisional patent filing or invention disclosure, routed through IIC.

- Incubation or pilot deployment of the solution through the institute's incubation cells
- Open-source release of the codebase for community use

9. THE TRL BASED EVALUATION FRAMEWORK

This Sections reproduce, as a companion framework to the Review Evaluation Rubrics the full TRL Based Project Maturity Evaluation Framework. This framework does not replace the Review Evaluation Rubric Sheets, it defines the TRL expected at each review stage, the evidence needed to justify a claimed TRL, and a scoring guide for converting the achieved-versus-target TRL gap into marks that feed into the overall review score.

Teams must state their project's starting TRL at Review 1 and target TRL at Final Viva using the scale below. Most EDDP teams are expected to progress from TRL 2–3 to TRL 5–6 over the course of the project. The scale adapts the widely used 9-level Technology Readiness Level framework originally developed by NASA and standard in engineering and R&D programme management to the scope and time-frame of an academic project. Review panels should interpret 'system' loosely as whatever the student is building a device, an algorithm, a software product, a process, or a research instrument.

Table 5 presents the Technology Readiness Level (TRL) framework adopted for Engineering Design and Development Projects. It outlines the progressive stages from the identification of basic principles and concept formulation to prototype demonstration, system qualification, and successful operation in real-world applications.

Table 5: Technology Readiness Level (TRL) Framework for Engineering Design and Development Projects

TRL	Descriptor	What This Looks Like in an Academic Project
TRL 1	Basic principles observed	Underlying scientific or engineering principle is identified; problem statement and literature survey establish the knowledge gap.
TRL 2	Concept formulated	A specific concept or approach is articulated; preliminary feasibility argued qualitatively; objectives and scope finalised.
TRL 3	Proof of concept (analytical/experimental)	Analytical modelling, simulation, or small bench-scale experiment confirms key parameters or the core hypothesis in isolation.
TRL 4	Component validation in lab environment	Individual components or modules are built and tested in a controlled lab setting, not yet integrated as a system.
TRL 5	Component validation in relevant environment	Components are integrated and tested under conditions that meaningfully resemble real operating conditions.
TRL 6	System/sub-system prototype demonstrated	A representative, largely complete prototype is demonstrated performing its intended function in a relevant environment.
TRL 7	Prototype demonstrated in operational environment	Prototype is tested in, or very close to, the actual environment/use-case, with end-user or field-like conditions.
TRL 8	System complete and qualified	Final system is complete and has passed the tests/certification needed to demonstrate it is ready for use.
TRL 9	System proven in operation	System is deployed and operating successfully in its actual, final application or handed over to an end user.

Target TRL by Review Stage

For the entire semester, the EDP is reviewed four times Review 1, Review 2, Review 3, and the Final Viva-Voce. Departments running a single-semester project should map their own review points onto this same progression. The following Table highlights the expected TRL at each review stage of the Engineering Design Project, mapping project timeline milestones to a technical maturity target.

Table 6 presents the progressive mapping of project review stages to the targeted Technology Readiness Levels (TRLs). It outlines the expected advancement of each project from problem identification and concept formulation through prototype development, testing, validation, and demonstration.

Table 6: Review-Wise TRL Progression for Engineering Projects

Review Stage	Target TRL	Expected State of the Project
Review 1 (Proposal / Concept Review)	TRL 1 – 2	Problem identified with literature survey; concept and objectives fixed; feasibility argued.
Review 2 (Design Review)	TRL 3	Design finalised; analytical/simulation-based proof of concept for core sub-systems complete.
Review 3 (Mid-Term / Prototype Review)	TRL 4 – 5	Components built and validated individually; initial integration begun and tested in lab conditions.
Pre-Final Review	TRL 5 – 6	Integrated prototype functioning; testing under conditions approaching real use; results being analysed.
Final Viva-Voce (Demonstration)	TRL 6 – 7	Working prototype demonstrated performing its intended function; performance validated against objectives.

TRL Claim Verification Requirements

A claimed TRL is a factual assertion, not a self-rating. Students must substantiate each claim with tangible evidence, and reviewers must verify that evidence before accepting it. No credit will be awarded for a TRL that is claimed but not evidenced; in such cases, the panel will score the project at the highest TRL that the evidence supports. This table specifies the documentary evidence a review panel must see before accepting a student team's claimed Technology Readiness Level, tying each TRL band to concrete proof rather than a self-declared score.

Table 7 presents the evidence requirements for assessing and validating the claimed Technology Readiness Level (TRL) of engineering projects. It specifies the documentary, experimental, prototype, testing, and operational evidence required by the evaluation panel at each stage of technology maturity.

Table 7: Evidence Requirements for TRL Assessment and Validation

Claimed TRL	Evidence the Panel Should See Before Accepting the Claim
TRL 1 – 2	Literature survey document; problem-statement write-up; concept note or design brief; feasibility discussion citing prior work.
TRL 3	Simulation files/output, analytical calculations, or bench-test data with a stated method, sample size, and result — not just a conclusion.

Claimed TRL	Evidence the Panel Should See Before Accepting the Claim
TRL 4	Individually tested component logs, test-bench photos/videos, code/module unit-test results, datasheets for chosen parts with justification.
TRL 5	Integration test records; test conditions and parameters used; comparison of results against the relevant (near-real) benchmark or standard.
TRL 6	Working prototype demonstrated live or on video; performance data against stated specifications; supervisor/panel observation notes.
TRL 7	Field/operational trial data, end-user or pilot-site feedback, comparison with operational requirements, environmental/stress test results.
TRL 8 – 9	Qualification/certification records, deployment or handover documentation, sustained operational data, sponsor/end-user acceptance sign-off.

TRL Gap and Score Guidance

The table presents a consolidated framework for evaluating TRL performance, integrating both qualitative interpretation and quantitative scoring criteria. It comprises of Scenario, Gap Value, Interpretation, TRL Attainment Score, and Guidance for the Panel and illustrates performance outcomes ranging from over performance to severe shortfall.

Table 8 provides guidance for interpreting the gap between the targeted and achieved TRL and assigning the corresponding attainment score. It enables the evaluation panel to consistently assess project progress, recognize overachievement, and identify the severity of shortfalls requiring corrective action.

Table 8: TRL Gap – Interpretation and Scoring Guidance

Scenario	Gap Value	Interpretation	TRL Attainment Score	Guidance for the Panel
Achieved > Target	Negative (capped at 0)	Project exceeded its commitment	10 / 10	Full credit; overperformance may be noted as a commendation
Achieved = Target	0	Met the committed milestone exactly	10 / 10	Full credit
Achieved < Target by 1	Positive (1)	Project underperformed against its own commitment	7.5 / 10	Minor shortfall — noted, not penalised heavily
Achieved < Target by 2	Positive (2)	Project underperformed against its own commitment	5.5 / 10	Moderate shortfall — improvement plan expected before next review
Achieved < Target by 3	Positive (3)	Project underperformed against its own commitment	3.5 / 10	Significant shortfall — guide and panel to flag risk to project completion
Achieved < Target by 4 or more	Positive (4+)	Project underperformed against its own commitment	1.5 / 10	Severe shortfall — refer to Project Coordination Committee

Blend the TRL Attainment Score with the existing Rubric Sheet score using the recommended weighting:
Overall Review Score = (0.75 × Rubric Sheet Score) + (0.25 × TRL Attainment Score × 10)

Both components are expressed as marks out of 100 before blending; the TRL Attainment Score (out of 10) should first be scaled by a factor of 10 as shown. The 75:25 weighting is a departmental default Project Coordination Committees may adjust it (recommended range 70:30 to 85:15) provided the same weighting is applied consistently across all project groups within a cohort and review stage.

Table 9 presents the roles and responsibilities of the key stakeholders involved in the assessment and validation of Technology Readiness Levels (TRLs). It establishes a structured process for TRL declaration, verification, evidence-based evaluation, and resolution of significant gaps in project progress.

Table 9: Roles and Responsibilities for TRL Assessment

Role	Responsibility
Student Team	Self-assess and declare the TRL achieved at each review, ahead of the review, with supporting evidence attached or ready to demonstrate.
Project Guide/Supervisor	Sanity-check the declared TRL before the review; ensure the team understands the target TRL for the upcoming stage; counsel on gap-closure if behind.
Review Panel	Independently verify the claimed TRL against the evidence in table 4; is not bound by the student's self-assessment; scores per table 4.
Project Coordination Committee	Own this framework; resolve disputes over TRL determination; review escalated cases with a TRL Gap of 4 or more at the Final Review.

10. EVALUATION SCHEME

Continuous Internal Evaluation: Progress is assessed through a series of scheduled reviews conducted by a departmental evaluation panel, typically comprising the project guide and one or more faculty members.

Table 10 summarizes the three formal reviews conducted during the Engineering Design Project, outlining the focus area assessed at each stage from problem formulation and design through implementation and final testing along with the common evaluation parameters applied across all reviews. Each review assesses defined milestones.

Table 10: Review-wise Evaluation Framework with TRL Mapping

Review	Title	Evaluation Focus on	Indicative TRL
Review 1	Problem Formulation and Design	Project proposal, literature survey, requirement specification, and design document	TRL 1–2 (Basic principles observed; concept formulated)
Review 2	Implementation Progress (Stage I)	Functional prototype or partial implementation, along with adherence to the proposed design and timeline	TRL 3–4 (Proof of concept; component validation in lab environment)
Review 3	Implementation and Testing (Stage II)	Completed, integrated solution along with testing and validation results	TRL 5–6 (System/subsystem validated in relevant environment)

SEE Evaluation: The Engineering Design Project is evaluated through a combination of continuous internal assessment and a final external evaluation, ensuring that both the process and the outcome of the project are fairly assessed.

This Table 11 summarizes the three components of the final evaluation, conducted by a panel that may include external examiners alongside internal faculty, assessing teams on their written report, working prototype demonstration, and individual understanding through a viva-voce examination.

Table 11: Final Evaluation Components with TRL Mapping

Component	Description	Indicative TRL
Project Report Evaluation	Assessment of the final project report for technical depth, clarity, completeness, and adherence to the prescribed format	TRL 6–7 (System prototype demonstrated in relevant environment)
Live Demonstration	Assessment of the working prototype presented by the team	TRL 6–7 (System prototype demonstrated in relevant environment)
Viva-Voce Examination	Oral examination assessing individual understanding of the project, technical concepts involved, and each member's specific contribution	TRL 6–7 (System prototype demonstrated in relevant environment)

Evaluation Parameters: This section outlines the six evaluation parameters applied consistently across all stages of the EDDP based on

- Technical soundness and originality of the solution
- Adherence to the defined design and methodology
- Quality and completeness of documentation
- Attainment of mapped Program Outcomes (POs) and Program Specific Outcomes (PSOs)
- Team coordination and individual contribution
- Quality of presentation and ability to respond to questions

Weightage

The overall grade for the EDDP is computed as a weighted aggregate of marks obtained across the continuous internal reviews and the final evaluation, with the exact weightage distribution prescribed by the department at the start of the academic year. Both individual and team performance are considered, allowing for differentiation in marks among team members based on their respective contributions. Total 6 weightage is distributed across continuous reviews and the final viva-voce as summarized below. Each review is assessed jointly by the internal guide and a review panel.

Table 12 presents the component-wise weightage and key evaluation criteria for assessing student performance in the EDDP. It provides a structured framework for evaluating project formulation, review-stage progress, technical development, functionality, and final demonstration through a balanced continuous assessment process.

Table 12: Component-wise Weightage and Evaluation Criteria

Component	Key Evaluation Criteria	Weightage
Problem Statement	Clarity of problem, relevance, literature grounding	5%
Review 1	Feasibility, scope, objectives, SDG/PO mapping	15%
Review 2	Design soundness, progress against plan, initial results	20%
Review 3	Functionality, testing rigor, report draft quality	20%
Final Viva-Voce	Working demo, technical depth, individual contribution, Q&A, final report	40%

11. REPORT FORMATTING GUIDELINES

Page & Font Specifications

- Paper size: A4; Margins: 1" (Left 1.25") on all sides
- Body text: Times New Roman, 12 pt, 1.5 line spacing, justified
- Chapter headings: 16 pt bold, Section headings: 14 pt bold, Sub-sections: 12 pt bold
- Page numbers: bottom-center; preliminary pages in lowercase roman numerals, main body in Arabic numerals

Structure of the Final Report

- Title page, Certificate, Declaration, Acknowledgement
- Abstract (250–300 words)
- Table of Contents, List of Figures, List of Tables, List of Abbreviations
- Chapter 1: Introduction
- Chapter 2: Literature Survey
- Chapter 3: System Analysis & Requirements
- Chapter 4: System Design & Methodology
- Chapter 5: Implementation
- Chapter 6: Testing & Results
- Chapter 7: Conclusion & Future Scope
- References (IEEE format)
- Appendices (source code excerpts, plagiarism report, sample screens)

12. PRESENTATION GUIDELINES

The final presentation is a critical component of the Engineering Design Project, providing teams the opportunity to communicate their work clearly and defend it before an evaluation panel. The following guidelines apply:

Structure and Content

- **Introduction**: A brief overview of the problem statement, motivation, and objectives of the project.
- **Literature Review**: A concise summary of existing work and how the proposed solution builds upon or differs from it.
- **Methodology and Design**: An explanation of the system architecture, design approach, and tools or technologies used.
- **Implementation**: A description of the key components developed, highlighting technical challenges and how they were addressed.
- **Results and Testing**: A presentation of the outcomes achieved, supported by data, test results, or performance metrics.
- **Conclusion and Future Scope**: A summary of the outcomes achieved and potential directions for future work or enhancement.
- **PO/PSO Mapping**: A brief indication of how the project addresses relevant Program Outcomes and Program Specific Outcomes, where required.

Format and Delivery

- Presentations should typically be completed within the time allotted by the department (commonly 15–20 minutes), followed by a question-and-answer session with the panel.
- Slides should be clear, uncluttered, and professional, using consistent formatting, minimal text per slide, and appropriate visuals such as diagrams, charts, or screenshots.
- Wherever applicable, teams should include a live demonstration of the working prototype rather than relying solely on static screenshots or recorded videos.
- All team members are expected to participate actively in the presentation, with responsibilities divided to reflect each member's contribution to the project.

- Teams should dress and conduct themselves professionally, arrive prepared with all necessary materials, and be ready to address technical questions from the panel.
- During the presentation, the panel typically assesses clarity of communication, depth of technical understanding, ability to justify design choices, responsiveness to questions, and the overall professionalism of the delivery. Teams are recommended to rehearse their presentation in advance to ensure smooth delivery within the allotted time.
- Slide decks should follow the institute template; 12–15 slides for reviews, 20–25 for the final viva.
- Every review must include a live or recorded demo of working functionality achieved to date.
- All team members must be present and able to answer questions on any part of the project.

13. ACADEMIC INTEGRITY & PLAGIARISM POLICY

Academic integrity is fundamental to the credibility and value of the EDDP. All students undertaking the project are expected to uphold the highest standards of honesty and originality throughout its execution. The following policy applies:

Principles

- The problem formulation, design, implementation, and analysis submitted must be the original work of the team, developed specifically for this project.
- Any external code, datasets, algorithms, frameworks, research papers, or other materials used or referenced must be clearly cited and attributed in the project report and documentation.
- Submitting work copied from previous batches, other teams, online repositories, or any other source without proper attribution and without substantial original contribution constitutes a violation of this policy.
- The use of open-source libraries, frameworks, and publicly available datasets is permitted and encouraged, provided their use is clearly disclosed and does not constitute the entirety of the project's contribution.
- All final project reports are subject to plagiarism screening using institute plagiarism detection software prior to submission.
- Reports must maintain a similarity index within the threshold prescribed by the department (commonly not exceeding 30%, excluding references and standard technical terminology).
- Reports exceeding the permissible similarity threshold will be returned to the team for revision and resubmission within a specified timeframe.

Declaration

Each team is required to submit a signed Plagiarism and Originality Declaration along with the final project report, affirming that the work presented is original and that all sources have been duly acknowledged.

Consequences of Violation

Instances of plagiarism, data fabrication, or academic dishonesty identified at any stage of the project will be dealt with in accordance with the Institute's academic integrity policy and may result in one of the following actions, depending on severity:

- Resubmission of the affected section with corrections
- Reduction of marks for the concerned deliverable or review
- Rejection of the project submission, requiring re-execution
- Referral to the Institute's disciplinary committee for further action, which may include penalties as per institutional regulations

Teams are strongly encouraged to maintain proper documentation of their sources and development process throughout the project to demonstrate the originality and integrity of their work at every stage.

- The final report must have a similarity index below the departmentally prescribed threshold (typically 30%, excluding references).
- A plagiarism/similarity report must be submitted along with the final report.
- Code plagiarism across teams, batches, or open-source sources without attribution is treated as academic misconduct and handled per institute policy.

14. MAPPING REQUIREMENTS (SDG / PO / PSO / WK / TRL)

To ensure that the EDDP meaningfully contributes to accreditation, societal relevance, and technological maturity, each team is required to map their project against four standard frameworks. These mappings must be clearly documented in the project proposal and final report.

Sustainable Development Goals (SDG) Mapping

- Teams must identify the relevant United Nations Sustainable Development Goal(s) that their project addresses or aligns with, either directly or indirectly.
- The mapping should include a brief justification of how the project's problem statement, solution, or intended impact relates to the selected SDG(s).
- Projects need not be restricted to a single SDG; where applicable, multiple relevant goals may be identified, provided the linkage is genuine and substantiated.

Program Outcome (PO) Mapping

- Teams must map their project activities and deliverables to the relevant Program Outcomes (POs) and Program Specific Outcomes (PSOs) as defined by the department, in line with NBA accreditation requirements.
- The mapping should indicate the specific POs/PSOs attained through distinct phases of the project (e.g., problem analysis, design, modern tool usage, teamwork, ethics, communication) rather than a blanket claim of attainment across all outcomes.
- A tabular PO/PSO mapping, along with a brief justification for each mapped outcome, should be included in the final report.

Knowledge Profile (WK) Mapping

- TEAMS must identify the relevant Knowledge Profile indicators (WK1–WK8, as applicable) that the project draws upon, reflecting the depth and type of engineering knowledge applied.
- This mapping should demonstrate how the project engages with foundational knowledge (e.g., mathematics, science), engineering fundamentals, specialist knowledge, and/or engineering design, as relevant to the problem addressed.
- The WK mapping should be presented alongside the PO/PSO mapping to provide a complete picture of the knowledge base underpinning the project.

Technology Readiness Level (TRL) Mapping

- Teams must assess and declare the Technology Readiness Level (TRL) of their solution at the start of the project and the TRL achieved by its conclusion, based on the standard 1–9 TRL scale.
- This mapping should be supported by a brief justification describing the evidence (e.g., prototype validation, testing environment, demonstration context) that supports the declared TRL.
- Where a project progresses across TRL stages during its execution, this progression should be clearly documented to reflect the maturity gained through the project lifecycle.
  All four mappings — SDG, PO, WK, and TRL — should be presented in a consolidated, tabular format in both the project proposal and the final report, enabling evaluators to quickly assess the project's academic, technical, and societal alignment.

15. TECHNOLOGY READINESS LEVEL (TRL)

Technology Readiness Level is a standardized scale (Figure 1) used to assess the maturity of a technology or solution, from initial concept through to fully proven operational deployment. Within the Engineering Design Project, TRL assessment helps teams and evaluators objectively gauge how far a solution has progressed from a theoretical idea to a validated, real-world-ready system.

The TRL Scale

- TRL 1 – Basic Principles Observed: The fundamental scientific or engineering principles underlying the concept have been identified and documented, typically from literature or theoretical study.
- TRL 2 – Technology Concept Formulated: A specific application or concept for the technology has been formulated, though still speculative and without experimental proof.
- TRL 3 – Experimental Proof of Concept: Analytical and experimental studies validate the core concept, often through small-scale simulations, algorithms, or lab-based tests.
- TRL 4 – Technology Validated in Lab: Individual components or subsystems are integrated and validated in a controlled laboratory or simulated environment.
- TRL 5 – Technology Validated in Relevant Environment: The technology, or key components, is tested in an environment that closely simulates real-world conditions relevant to its intended use.
- TRL 6 – Technology Demonstrated in Relevant Environment: A representative prototype or model is demonstrated in a relevant environment, showing that the system performs as intended under near-realistic conditions.
- TRL 7 – System Prototype Demonstrated in Operational Environment: A near-final prototype is demonstrated in an actual operational environment, going beyond simulated conditions.
- TRL 8 – System Complete and Qualified: The technology has been proven to work in its final form under expected operating conditions, with all functional testing completed.
- TRL 9 – Actual System Proven in Operational Environment: The technology has been successfully deployed and used in its final, real-world application, with no further developmental testing required.

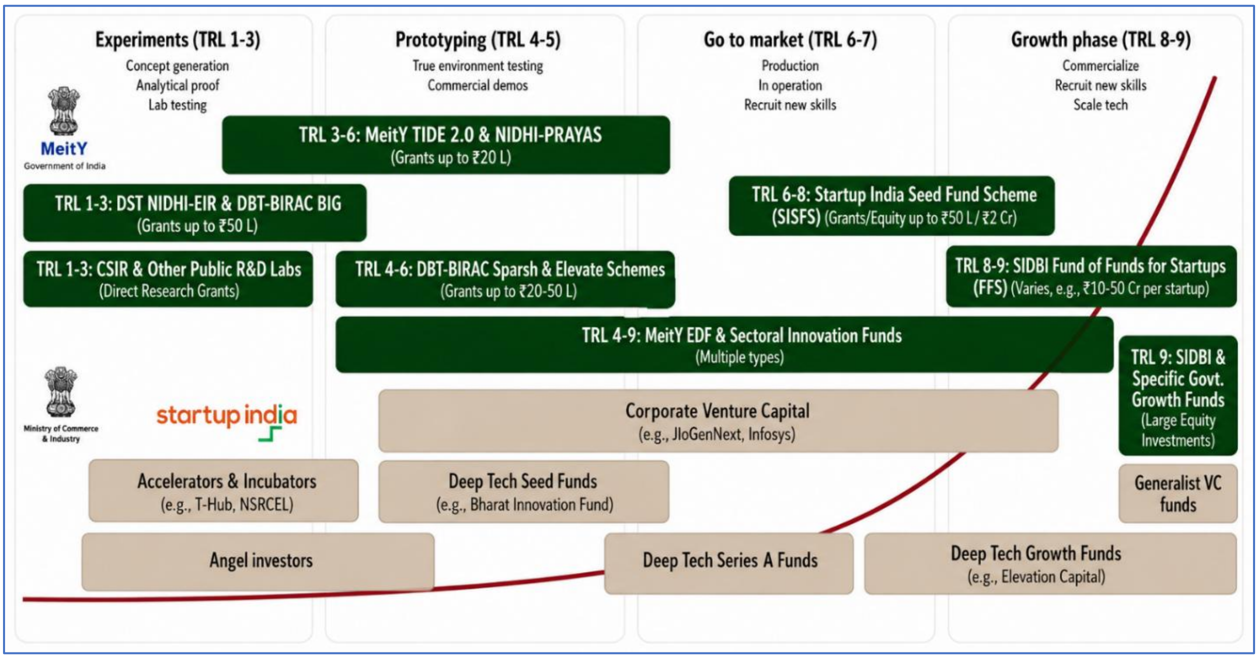

Figure 1: Technology Readiness Level with possible funding agency

Appendix

Templates

To ensure consistency, ease of evaluation, and adherence to institutional standards, teams are required to use the standardized templates and reference documents prescribed by the department throughout the Engineering Design Project. These are typically made available at the start of the academic year via the department office or institutional repository.

Prescribed Templates

- Project Proposal Template
- Literature Survey Template
- Design Document Template
- Progress Report Template
- Final Project Report Template (https://www.iare.ac.in/sites/default/files/news/Guidelines_for_B.Tech_Project-April_2020.pdf)
- Presentation Template
- SDG / PO / WK / TRL Mapping Table Template.
- Plagiarism and Originality Declaration Form

Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Sustainable Development Goals

IARE proud to align the work with all 17 of the United Nations Sustainable Development Goals. These goals address global challenges including poverty, hunger, health, clean energy, quality education, gender equality, climate action, and much more — reflecting a holistic vision for a better world.