



FORGE.ACADEMY

TALENT **Generation & Development**



PROTO^{EM}

INNOVATION ENGINEERS

GRADUATE INNOVATION ENGINEER
CERTIFICATION

FROM I-SHAPED SPECIALISTS TO M-SHAPED INNOVATION ENGINEERS

20 WEEKS

FULL-TIME INNOVATION
FELLOWSHIP

21 CREDITS

CURRICULUM-INTEGRATED

6 TRACKS

SPECIALISATION DOMAINS

1 MUP

MINIMUM USABLE PROTOTYPE

VERTICALLY INTEGRATED ENTERPRISE BUILDING & OPERATING A NATIONAL-SCALE OPEN INNOVATION NETWORK

WHY FORGE?

Powering India's Innovation Economy in the Industrial Intelligence Age.

Forge Innovation & Ventures is a vertically integrated enterprise for building and operating a national-scale Open Innovation Value Network to catalyse talent, technology and ventures with the core purpose of powering India's innovation economy in the Industrial Intelligence Age.

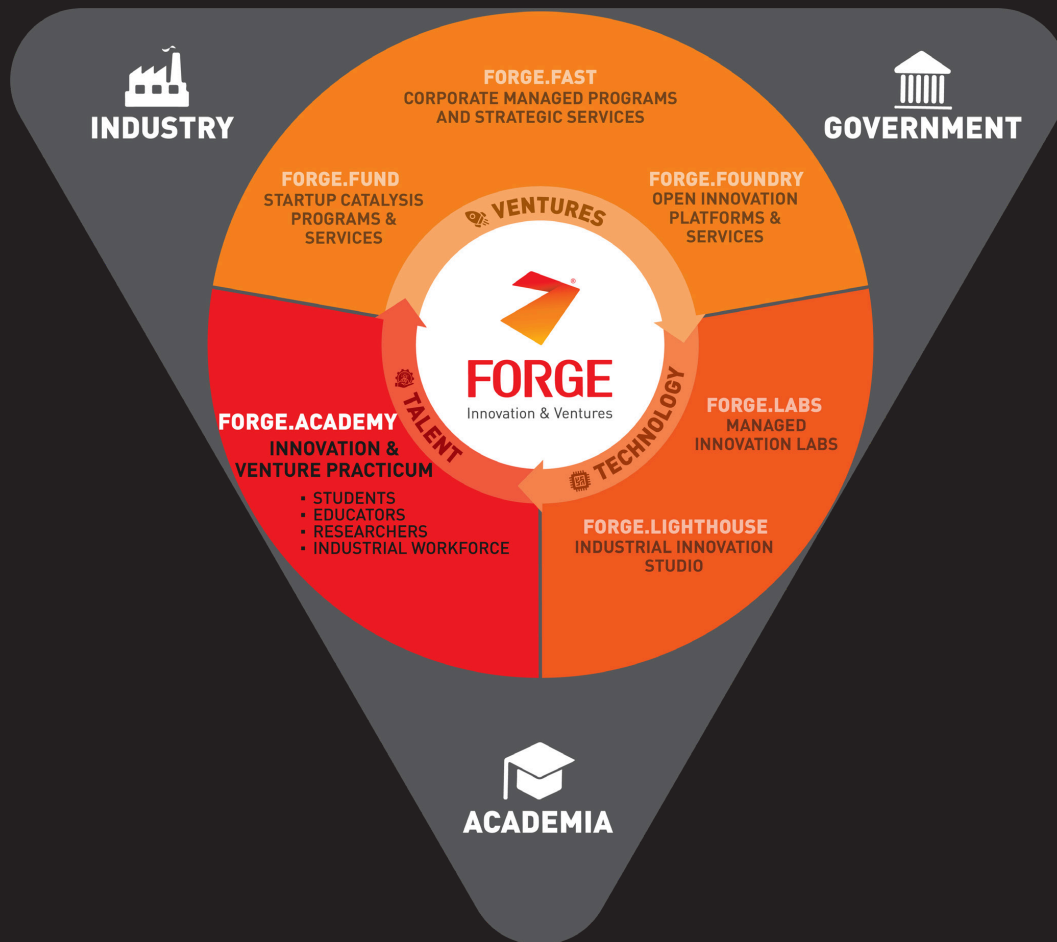
Two major themes of disruption as envisaged by Forge across the Industrial Intelligence Age are (a) the **PLATFORMISATION OF HARDWARE PRODUCTS**; and (b) the **INDUSTRIALISATION OF PHYSICAL AI**, which both leverage breakthrough hardware innovations (hardware-first) and deliver disruptive digital intelligence (digital-plus) — together called Phygital tech — to create & capture exponential value in industrial value-chains. To seed, accelerate & scale these Phygital Tech Innovations & Ventures, the crucial stages of production & industrialisation require strategic capability building and ecosystem scaling — achievable only by converging academia, industry and government around the crucial factors of transformation: Talent, Technology & Ventures.

Materialising hardware innovations calls for Manu'Futuring — the unification of 'Technology in Hardware Manufacturing' and 'Manufacturing of Hardware Technologies' — driving transformation across hardware tech domains through the next generation of machines, materials, components and devices. To successfully build & scale these Phygital Innovations FROM, IN & FOR India, Forge operates in the entire innovation value chain covering talent transformation, technology labs, product innovation, startup incubation, venture acceleration, and seed investments.

Among India's top incubators and accelerators, Forge implements open innovation to deliver transformation by enabling the public sector (government-owned industries & enterprises) and private sector (small to large industrial companies) to collaborate with startups as technology & growth partners.

HOW FORGE?

Our Strategy Framework & Execution Model



Forge's strategy and execution is organised, operated, and optimised around **6 Strategic Program Verticals (SPVs)** – the foundational pillars of a structured framework spanning government, academia and industry, with innovators, entrepreneurs, investors & key ecosystem enablers.

This brochure is dedicated to **ProtoSem®** – the flagship certification of the **Forge.Academy** SPV, which operates under Forge's Talent arm and enhances engineering education through the Innovation Practicum.

152+

PHY'GITAL STARTUPS

₹7,000 CR+

COMBINED PORTFOLIO
VALUATION

2,200+

JOBS CREATED BY STARTUPS

8

FUTURESCOPE DOMAINS

TAMIL NADU'S INDUSTRIAL INNOVATION NETWORK

8 stations · 1,80,000+ sq.ft. · #1 Private Sector Incubator (physical space) · 7 MIT-accredited FabLabs – India's largest FabLab network.
Part of the **Kumaraguru Group**.

TALENT GENERATION

FOR RESEARCH, ENTREPRENEURSHIP & INDUSTRY

Talent as the Fuel for Harnessing Technology as the Engine of Industrial Transformation

Tech **ENABLING** the business

Focused on digitising data and processes to streamline workflows, reduce human error, and speed up tasks.

Skill-based contribution with task-level execution

Performs defined tasks using acquired vocational skills.

Relies on instruction-led support roles within operations.

Limited exposure to systems thinking or problem-solving frameworks.

Tech **OPERATING** the business

Tech-led operating infrastructure runs entire enterprise operations over digital platforms for productivity and analytics.

Applied learning and functional expertise

Owns operational processes and improves efficiency.

Applies domain knowledge to solve real-world challenges.

Begins transitioning from task execution to decision-making roles.

Tech **WINNING** the business

Technology becomes the inseparable part of the product, and is the key aspect that makes the business win.

Technology-powered innovation and adaptive learning

Applies interdisciplinary knowledge to redesign processes.

Leverages technology, data and systems to drive transformation.

Uses education-driven insights to align solutions with business goals.

PROTOSEM® TARGETS THIS STAGE

TECH BECOMING THE BUSINESS

Technology IS the core driver of the business that creates and delivers value.

Strategic leadership through lifelong learning and innovation

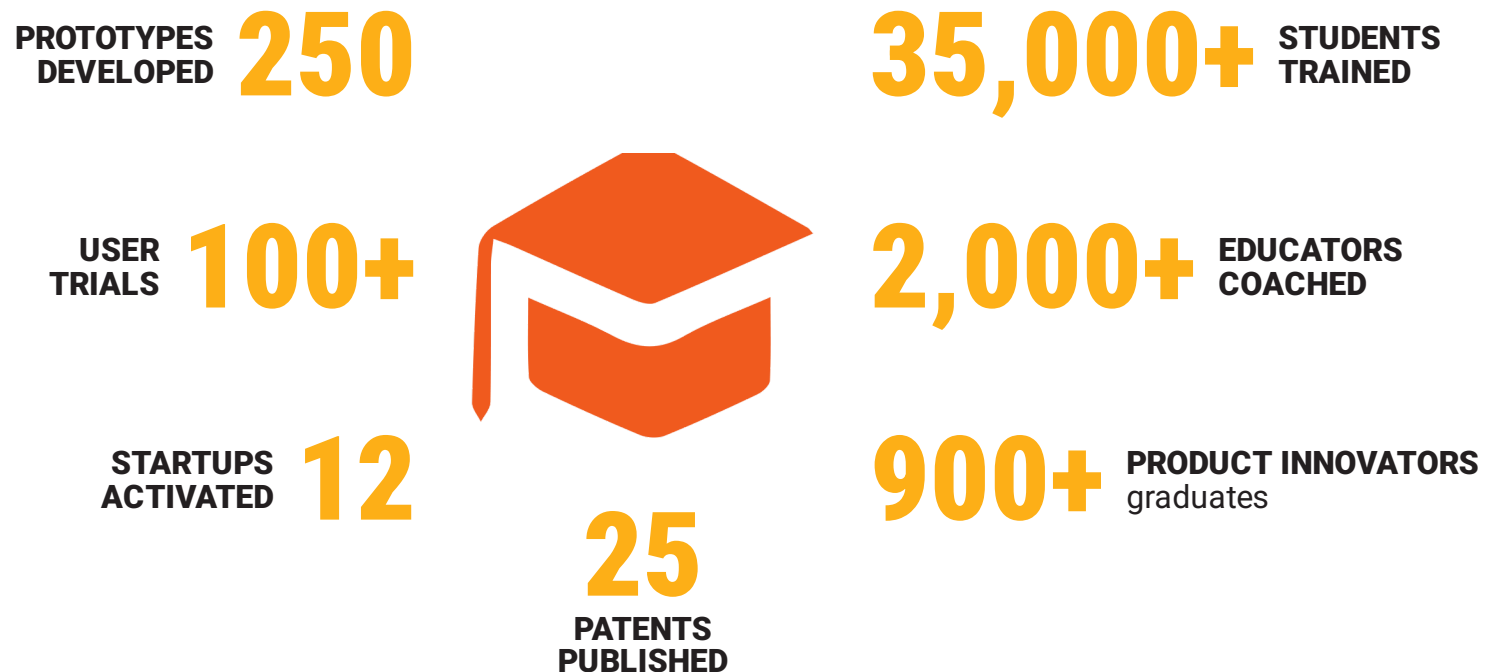
- System-level thinking, business model innovation, leadership in transformation
- Continuous education, strategic foresight, decision-making under complexity
- Talent capable of architecting new manufacturing paradigms and driving enterprise-wide change
- Talent that is not just workforce-ready but enterprise-ready

INDUSTRIAL INNOVATION TALENT DEVELOPMENT

INNOVATION PRACTICUM

TALENT AS TECH INNOVATORS AND ENTERPRISE BUILDERS

Forge's Innovation Practicum is a curriculum-integrated framework, strategically focused on driving trans-disciplinary innovation through multidisciplinary student teams. Anchored in higher technical education, it cultivates next-generation talent by co-creating with industrial companies, public sector departments, and tech startups. **ProtoSem® is the Practicum's flagship Tier-2 certification.**



TIER-2: INNOVATION CERTIFICATION

GRADUATE INNOVATION ENGINEER CERTIFICATION PROGRAM



ProtoSem® is a structured, 20-week innovation practicum that transforms pre-final and final-year undergraduate engineering students from various disciplines into innovation-capable technical & entrepreneurial talent — through hands-on learning, interdisciplinary problem-solving and real-world product development.

Offered by Forge Innovation & Ventures, India's largest Open-Innovation network for Phygital Tech Innovation & Ventures, the program is university-accredited, curriculum-integrated and industry-aligned — immersing students in industry-defined challenges to build deployable solutions.



CURRICULUM-INTEGRATED LEARNING

A structured pathway from foundation to specialisation, spanning design thinking, startup fundamentals, hardware/software engineering, automation and digital systems.



INDUSTRY-ANCHORED PROJECTS

Interdisciplinary teams solve real-world challenges, delivering transdisciplinary solutions and Minimum Usable Prototypes (MUPs).



MULTIDISCIPLINARY TECH IMMERSION

Practical exposure to IoT, AI, robotics, AR/VR, additive manufacturing, industrial automation and edge computing.

WHO IT'S FOR

Pre-final & final-year undergraduates — Engineering, Arts & Science and Management students in multidisciplinary teams

FORMAT

20 weeks, full-time · flipped classroom · industry-sponsored live challenges · Demo Day

CREDENTIAL

Graduate Innovation Engineer Certification — university-accredited, curriculum-integrated



THE ENGINEER'S MANDATE IN THE INTELLIGENT ECONOMY

The global industrial landscape is rapidly transitioning to the **Intelligent Age** — a phase defined by the convergence of digital and physical worlds. This transformation mandates a new generation of engineering talent capable of mastering complex **Advanced Digital Production & Intelligent Manufacturing (ADPIM)** technologies.

Cyber-Physical Systems

Digital Twins

Industrial IoT

AI/ML for Manufacturing

Intelligent Automation

Traditional engineering education produces **I-shaped specialists** — deep vertical knowledge, limited cross-disciplinary breadth. Industry 4.0 demands **M-shaped professionals** with expertise across multiple domains and strong interdisciplinary durable skills.

ProtoSem® blends expert training, technology mentoring and live industrial project work — validated by rigorous psychometric pre-post assessment.

FROM I-SHAPED SPECIALISTS TO M-SHAPED INNOVATORS



I-SHAPED

Deep vertical expertise only — limited cross-domain ability.



T-SHAPED

One deep domain + broad collaborative ability across disciplines.



V-SHAPED

Graduated depth across adjacent domains — evolving versatility.

PROTOSEM OUTCOME



M-SHAPED ★

Multiple deep specialisms + interdisciplinary durable skills.

GRADUATE INNOVATION ENGINEER TALENT ACCELERATOR TO GLOBAL COMPETENCY

The **Graduate Innovation Engineer** is a professional credential signifying competence in deployment and outcome-driven innovation. This intensive, 20-week certification serves as a talent accelerator, providing verifiable, translatable proof-of-work much faster than conventional academic pathways.

ProtoSem® is specifically designed to create professionals skilled in building technology-led innovations — a crucial competency for next-generation product development. It prepares talent for the most advanced stages of enterprise growth, where technology is not just enabling but actively becoming the core driver of the business.

Participants earn the credential backed by 20 weeks of programme data, ePortfolio documentation, failure logs and prototype deliverables.

THE CORE DELIVERABLE

MUP

MINIMUM USABLE PROTOTYPE

Delivering a functional MUP ensures students transition from theoretical analysts to **Innovation Engineers** who deliver tangible, verifiable solutions.

The prototype becomes each student's primary professional portfolio project — highly valued by global recruiters and investors seeking proof of real-world deployment capability.

20

WEEKS, FULL-TIME

4

LEARNING PHASES

6

SPECIALISATION
TRACKS

21

ACADEMIC CREDITS

86+

INNOVATION
MENTORS

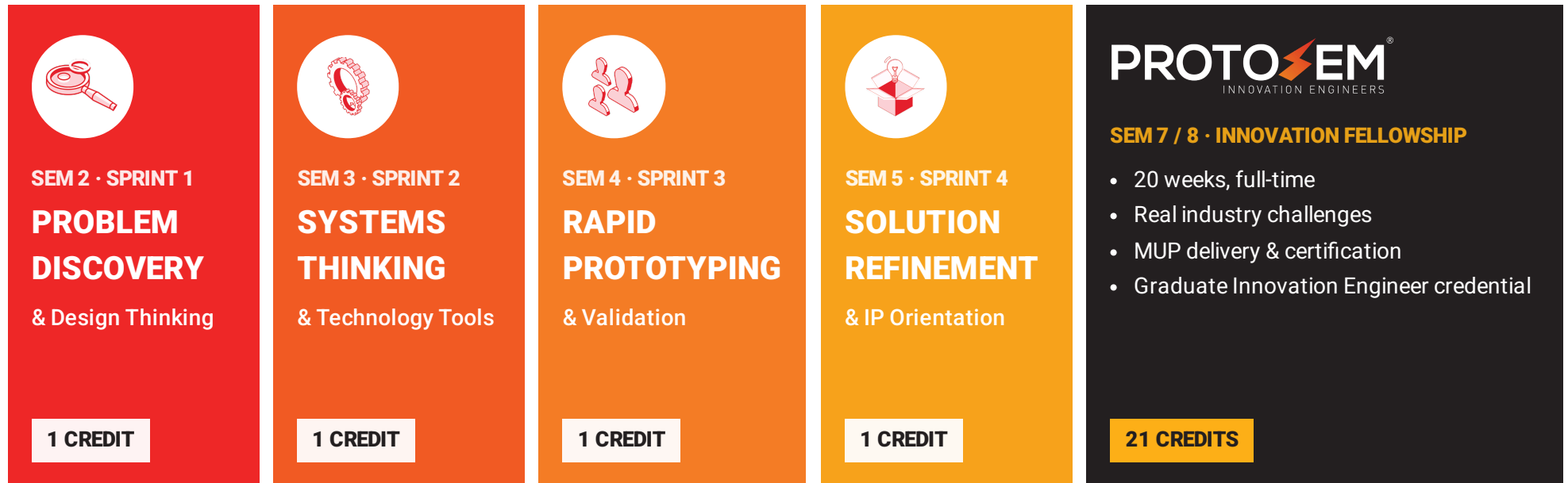
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ITEM PRE-POST
ASSESSMENT

INNOVATION PRACTICUM ARCHITECTURE

A SCAFFOLDED, MULTI-SEMESTER PATHWAY

Foundational learning sprints (Semesters 2–5) build the innovation mindset step by step, culminating in the ProtoSem® capstone fellowship in Semester 7 or 8.



4 + 21 = 25 credits in total — Sprints (Sem 2–5) + ProtoSem® Fellowship, fully curriculum-integrated



What comes next: teams with entrepreneurial potential can advance their ProtoSem® projects into LaunchSem, Forge's pre-incubation program, to build deployable products and ventures.

CURRICULUM STRUCTURE

FOUR PHASES. TWENTY WEEKS.

Developed under the innovation-centric learning model, the curriculum is structured across four phases to maximise learning velocity and the immediate application of skills.

PHASE 1 · 5 WEEKS FOUNDATION

CORE COMPETENCIES

Design thinking, entrepreneurial mindset, IP strategy

KEY TECHNICAL TOPICS

- Applied Design Thinking
- Startup Fundamentals
- Minimum Viable Business (MVB)
- Intellectual Property Rights

PHASE 2 · 5 WEEKS CONCENTRATION

CORE COMPETENCIES

Digital systems base, hardware/software foundations, rapid prototyping

KEY TECHNICAL TOPICS

- IoT Sensors & Embedded Platforms
- OOPS Programming
- Industrial Design
- Rapid Prototyping

PHASE 3 · 5 WEEKS SPECIALISATION

CORE COMPETENCIES

Industrial AI, robotics, cyber-physical systems integration

KEY TECHNICAL TOPICS

- Industrial Automation (PLC)
- Data Life Cycle Management
- ML 101 · ROS
- Robot Kinematics · Vision Systems

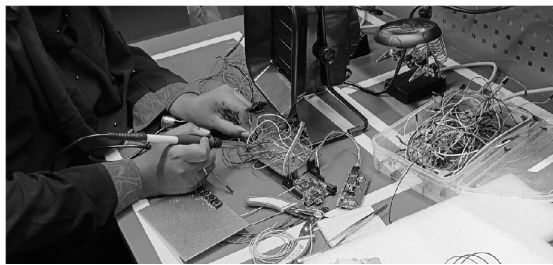
PHASE 4 · 5 WEEKS CAPSTONE

CORE COMPETENCIES

MUP deployment, industry readiness, commercialisation pathway

KEY TECHNICAL TOPICS

- Real-world industrial innovation project
- Final prototype testing & refinement



HOW PROTOSEM® WORKS

ONE TRANSFORMATIVE LEARNING JOURNEY

MEZIROW

Transformative learning — the disorienting dilemma that breaks old assumptions.

KOLB

Experiential learning — experience, reflect, conceptualise, experiment.

KEGAN

Adult development — from the Socialised Mind to Self-Authorship.

01

PROBLEM FRAMING & FOUNDATION

WEEKS 1–5

Mezirow: the disorienting dilemma · Kolb: concrete experience + reflective observation

Live industry challenges immediately expose the limits of classroom knowledge. Design thinking, customer discovery, stakeholder mapping and market-need validation anchor this phase as students confront VUCA complexity head-on.

02

MULTIDISCIPLINARY TECH IMMERSION

WEEKS 6–10

Kolb: the full experiential cycle

Hands-on labs across IoT, AI, robotics, AR/VR, edge computing, additive manufacturing and industrial automation. Every lab follows the full cycle as students progressively build V-shaped breadth across technology domains.

03

PROTOTYPE, FAIL & ITERATE

WEEKS 11–17

Kegan: self-authorship in high-ambiguity conditions

Interdisciplinary teams tackle live briefs with minimal scaffolding, developing each student's internal voice. Sprint reviews, industry mentor critiques, failure logs and user-validation cycles build Collaborative Leadership.

04

DEPLOY, MEASURE & CERTIFY

WEEKS 18–20

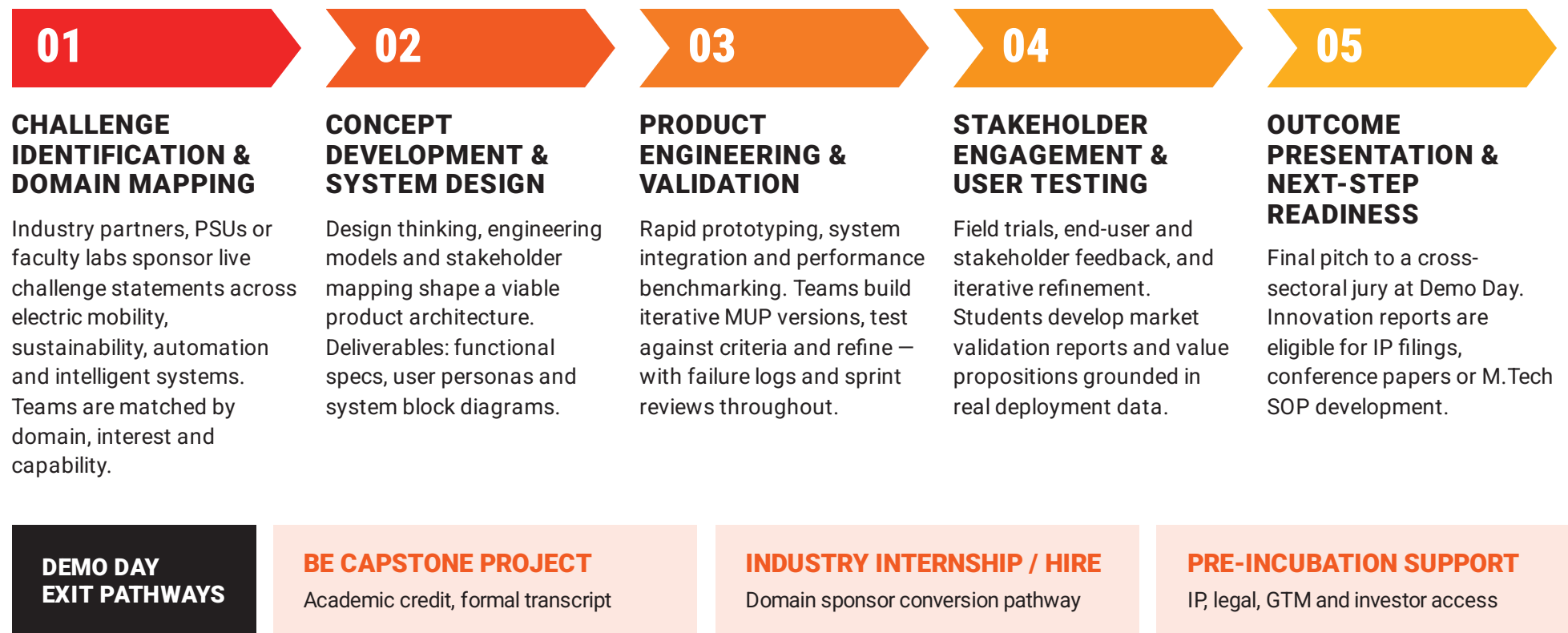
All three pillars: reintegration

Teams deliver MUPs to industry partners. A 70-item psychometric post-assessment across six constructs quantifies the mindset shift using Cohen's d effect sizes. Graduates receive the Graduate Innovation Engineer certification.

5-PHASE EXECUTION FRAMEWORK

FROM CHALLENGE TO CERTIFIED INNOVATION

Each phase mirrors real-world product development — supervised by industry mentors and evaluated by an external jury.



SPECIALISATION TRACKS

SIX DOMAINS. ONE INNOVATION METHOD.

Students choose one domain track — each delivered within the shared ProtoSem® innovation methodology.

ATTaMS

Advanced Technical Textiles & Manufacturing Systems

Smart materials, automated production systems, quality sensing and sustainable manufacturing for Industry 4.0.

PRICE

Phygital Retail & Intelligent Commerce & Entrepreneurship

AI-driven personalisation, smart shelving and omnichannel data systems converging physical and digital commerce.

PICS

Phygital Industrial Control Systems

OT/IT convergence, SCADA, embedded controllers and secure cyber-physical architectures for critical infrastructure.

ASADI

Agentic Systems for Autonomous Decision Intelligence

AI agents, multi-modal reasoning, LLM orchestration and autonomous decision pipelines for complex industrial tasks.

AMES

Autonomous Mobility & Energy Systems

Electric drivetrains, renewable integration, robotics navigation and sustainable mobility engineering solutions.

SHIELD

Strategic Hardware & Intelligent Engineering — Land, Air & Maritime Defence

Ruggedised systems design, dual-use hardware and intelligent sensor fusion for advanced defence-grade applications.

PEDAGOGY

THE INNOVATION-CENTRIC LEARNING MODEL

The volume of advanced technical content delivered within 20 weeks calls for highly effective pedagogy — designed to cultivate talent capable of technology-powered innovation and adaptive learning.

1 FLIPPED CLASSROOMS

Students consume lecture content outside class, dedicating in-class time entirely to intensive, hands-on work.

Systems thinking exercises

Technology labs

Product design & development

Customer discovery

2 PROJECT-BASED LEARNING

Students engage in real-world scenarios, including capstone projects with industry and deep-tech startups that train practical problem-solving.

Industry simulations & digital twins

Hackathons

Real factory data labs

3 ACTION LEARNING PROJECTS

Real-world industrial projects focused on deployment and enterprise readiness, culminating in a deployment-ready prototype.

Scope definition documentation

Agile product development sprints

Hackathons

4 INDUSTRY MENTORSHIP

Expert mentorship bridges the academia-to-industry gap — guidance on industry trends, professional communication and career mapping. Students co-create with corporate partners, manufacturing companies and deep-tech startups, keeping innovations commercially viable and scalable.

86+
INNOVATION
MENTORS

PROFESSIONAL PRACTICES & CURRICULUM BEYOND TECHNICAL SKILLS

VALUES & ETHICS

ORGANISATION VALUES Resilience · Integrity · Ownership · Driven · Learnability

SOCIAL VALUES Collaboration Skills · Inclusivity · P.R.I.D.E. · WISE Initiative

TECHNO ETHICS Experimental Enquiry · Consultant Mindset · Digital Rights

CORPORATE PRACTICES

INDIVIDUAL MANAGEMENT OKRs · Working Out Loud · Presentation Skills · Decision Making

DEVELOPMENT PRACTICES Agile Product Development · PLM · Stakeholder Management

COLLABORATIVE WORKING Remote Work · Brainstorming · Team Organisation · Email Etiquette

INNOVATION MODULES

Problem framing · Design methods · Opportunity discovery · IP orientation

PROTOTYPE DEVELOPMENT

Value proposition validation · MUP build · Field trials · Demo Day

TECHNOLOGY MODULES

IoT · AI · Robotics · AR/VR · Automation · Additive manufacturing · Edge computing

CORE DIFFERENTIATORS

BUILT FOR MEASURABLE INNOVATION OUTCOMES



MULTI-DISCIPLINARY MODEL

Integrates students from Engineering, Arts & Science and Management for holistic problem-solving and diverse collaboration.



INDUSTRY-ALIGNED

Real-world challenges sourced from corporate partners, manufacturing companies and deep-tech startups.



MENTORSHIP-INTEGRATED

Guided by industry leaders, technical specialists and innovation coaches who accelerate learning and execution.



OUTCOME-ORIENTED

Culminates in validated prototypes, impact theses and go-to-market plans that strengthen portfolios and industry adoption.

MEASURABLE MINDSET TRANSFORMATION

A validated pre-post psychometric instrument quantifies each student's growth — so graduates leave with quantitative evidence of development, not just a certificate on paper.

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70

ITEM PRE-POST ASSESSMENT

6

CONSTRUCTS MEASURED

d

Cohen's *d* effect sizes

KEY OUTCOMES & CAREER PATHWAYS

READY TO CONTRIBUTE FROM DAY ONE



DIFFERENTIAL EMPLOYABILITY

Multidisciplinary skills for specialised technical roles in Intelligent Manufacturing – raising each engineer's Innovation Quotient (IQ), assessed with the Graduate Engineering Rubric.



VENTURE CREATION

Mastering Applied Design Thinking and Startup Fundamentals and building an MUP equips students to pursue technical entrepreneurship and seed funding.

01 INDUSTRY EMPLOYMENT

Job-ready competencies in systems thinking, problem solving, rapid prototyping and cross-functional project execution – evidenced in a Digital Portfolio.

- Prototypes & stakeholder reports form a placement-ready digital portfolio
- Direct hiring pathways via domain sponsors and industry mentors
- A visible track record before final-year recruitment

Product Development Engineer · R&D Associate
· Systems Designer · Automation Engineer

02 ENTREPRENEURSHIP & STARTUPS

Students with entrepreneurial potential are identified during ProtoSem® for structured pre-incubation – business model coaching, pitch development and funding readiness.

- Access to prototyping labs, legal/IP support and GTM mentorship
- Introductions to early-stage investors and curated pitch events
- Startup readiness assessments and Demo Day cohorts

Teams graduate into Forge's incubation programme or partner ecosystems

03 HIGHER EDUCATION & RESEARCH

Transdisciplinary, problem-centric projects involving real data, real users and systems-level engineering prepare students for research careers.

- Innovation reports and PoCs convertible to papers and journals
- Documentation strengthens M.Tech / MS / PhD SOPs
- Faculty mentorship opens collaborative research pathways

Research Intern · M.Tech / MS Candidate · PhD Scholar · Innovation Policy Analyst

FOR UNIVERSITY PARTNERS

WHY SEND YOUR STUDENTS TO PROTOSEM®

01

MEASURABLE MINDSET TRANSFORMATION

A validated 70-item pre-post instrument measures six constructs, giving students quantitative evidence of personal growth.

02

DEEP IMMERSION IN INDIA'S INNOVATION ECONOMY

Exposure to Forge.Academy's industry-sponsor network across manufacturing, defence, retail-tech, AI and autonomous systems.

03

GRADUATE INNOVATION ENGINEER CERTIFICATION

A credential backed by programme data, ePortfolio documentation, failure logs and prototype deliverables.

04

REAL CROSS-CULTURAL TEAM EXPERIENCE

Mixed-nationality, interdisciplinary cohorts work on live industrial briefs — building intercultural leadership that global employers value.

05

DATA YOUR INSTITUTION CAN USE

Cohen's d effect-size reports support ABET, NBA, AACSB and equivalent accreditation submissions — publication-grade institutional data.

06

STRATEGIC UNIVERSITY PARTNERSHIP

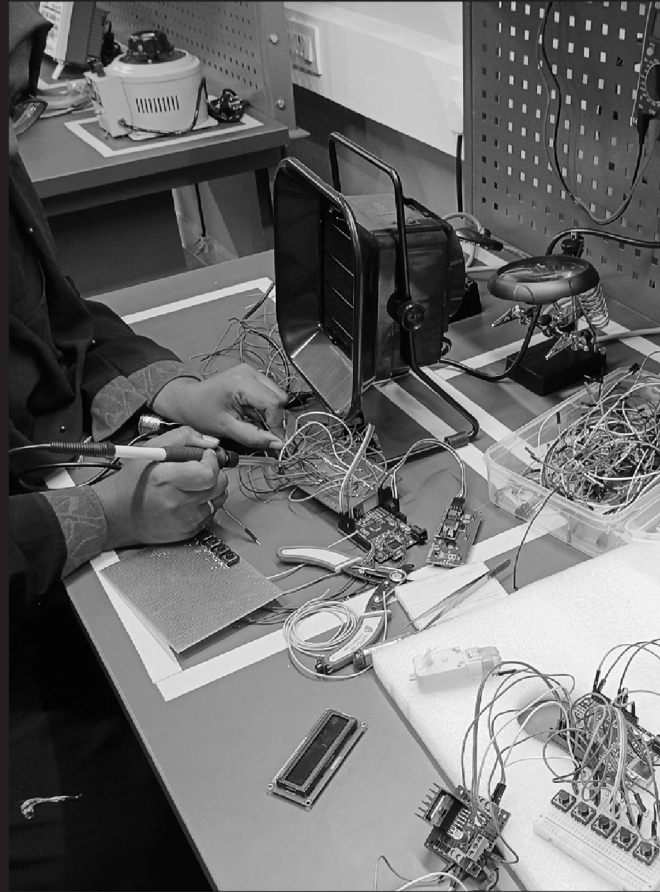
Co-branding on outputs, access to Forge.Academy's research network, joint publication pathways and a structured exchange pipeline.

READY TO SEND YOUR STUDENTS?

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The ecosystem behind ProtoSem® challenges, mentors and labs

**DIRECTORATE OF
TECHNICAL EDUCATION**
Government of Tamil Nadu





FORGE.ACADEMY

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