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Prof. Keshav Sharma
Vice-Chancellor
ICFAI University, Himachal Pradesh (IUHP)

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AI IN ENGINEERING

MORE CREATIVE OR LESS?

Ask any engineering student today about artificial intelligence and the conversation quickly turns to productivity. AI can write code, generate designs, solve equations, summarize research papers, and even suggest solutions to technical problems. It can do in minutes what might have taken hours before.

But there is a bigger question that does not get discussed enough. Will AI make engineers more creative or less?

The answer is not as straightforward as it may seem.

On one hand, AI has the potential to boost creativity. Engineers often spend a large part of their time on repetitive tasks. They test different designs, run simulations, check calculations, and search for information. AI can speed up many of these processes. Instead of spending hours creating multiple design options, an engineer can generate dozens of possibilities within minutes.

This gives engineers more time to focus on what humans do best. And that's thinking, experimenting, and solving problems in new ways.

Consider a student working on a drone design project. Instead of starting with a blank page, AI can generate several possible designs. The student can then evaluate them, improve them, and combine ideas from different versions. In this case, AI acts like a tool that expands the engineer's options.

History shows that new tools often increase creativity rather than reduce it. Computer-aided design software did not eliminate engineers. It allowed them to design more complex products than before. AI may follow a similar path.

However, there is another side to the story.

Creativity is not only about producing answers. It is also about struggling with a problem, making mistakes, and discovering unexpected solutions. Many of the best engineering ideas emerge during this process.

If students begin relying on AI for every task, they may miss out on developing these skills. When a machine provides an instant answer, there is less incentive to explore different approaches or understand why a solution works.

There is also a risk that AI-generated outputs start to look similar. Since many systems are trained on existing data, they often produce designs based on patterns that already exist. This can encourage safe and familiar solutions rather than truly original thinking.

Engineering progress often comes from challenging accepted ideas. Some of the most important inventions looked unusual or impractical when they first appeared. If engineers become too dependent on AI-generated suggestions, they may be less likely to question them.

The future will probably lie somewhere between these two extremes.

AI is unlikely to replace human creativity, but it will change how creativity is expressed. Engineers who simply accept whatever AI produces may become less innovative. Those who use AI as a starting point, while continuing to question, test, and improve ideas, may become even more creative than previous generations.

The real challenge for engineering students is not learning how to get answers from AI. It is learning how to think beyond those answers.

After all, engineering has never been about finding the easiest solution. It has always been about finding the best one. That still requires curiosity, imagination, and the willingness to ask questions that no machine can answer on its own.

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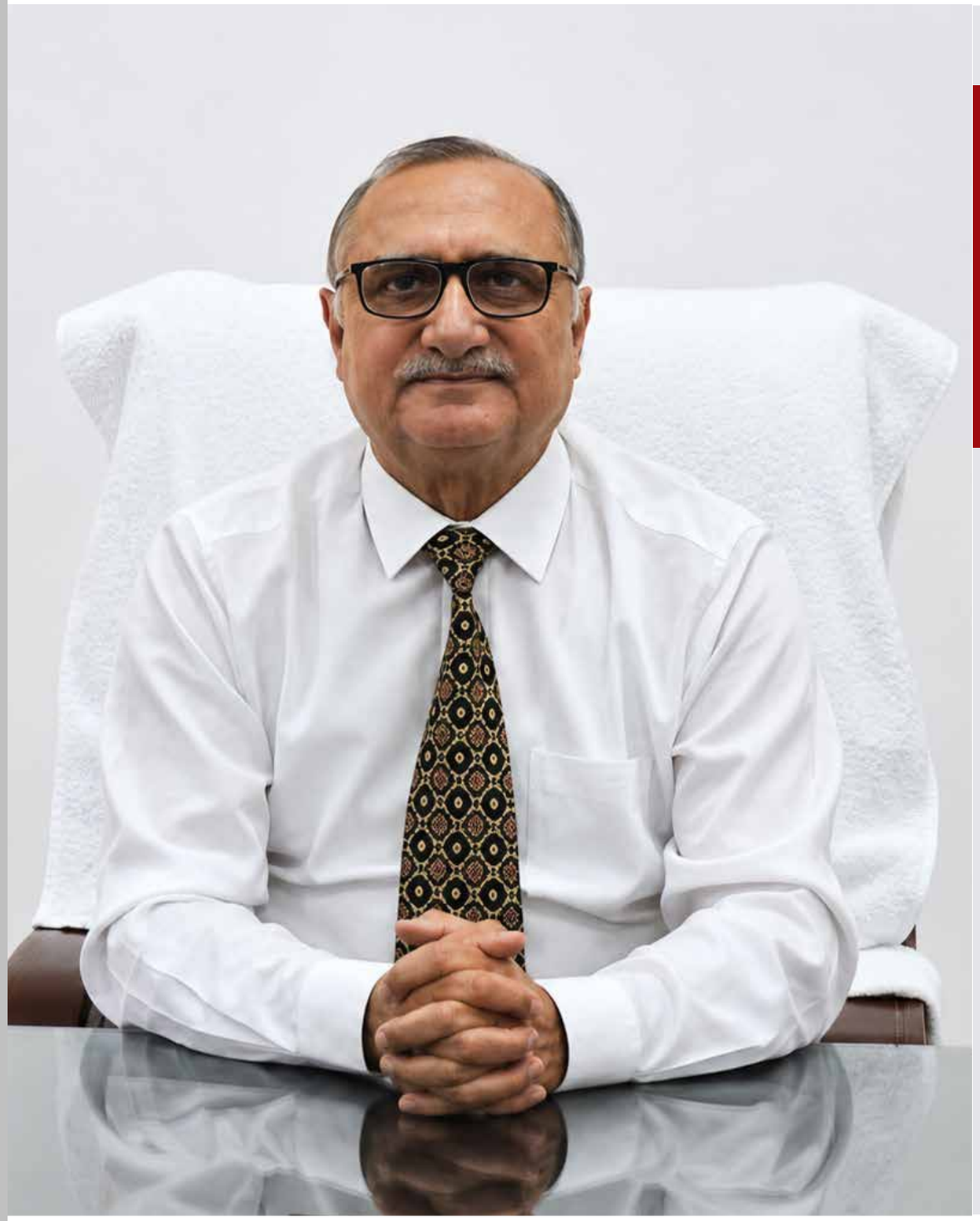


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THE ENGINEER OF 2035 MUST BE AN **INNOVATOR, LEADER, AND RESPONSIBLE GLOBAL CITIZEN**

Prof. Keshav Sharma
Vice-Chancellor
ICFAI University, Himachal Pradesh (IUHP)

For over four decades, ***Prof. Keshav Sharma,*** *Vice-Chancellor, ICFAI University, Himachal Pradesh has witnessed Indian higher education evolve from a knowledge-delivery system into a dynamic ecosystem expected to nurture innovators, entrepreneurs, researchers, and socially responsible leaders. Having served in virtually every major academic and administrative role—from Dean Academic Affairs and Registrar to Vice-Chancellor—his perspective is shaped by extensive institutional leadership, quality-assurance experience, and exposure to global university ecosystems. In this exclusive interview with Education Post's* ***Prabhav Anand,*** *Prof. Sharma discusses the future of engineering education in the age of artificial intelligence, the limitations of placement-centric success, the urgent need for industry-academia integration, and why human values must remain at the heart of technological advancement.*

You have spent over four decades navigating almost every major academic and administrative role within higher education—from Dean Academic Affairs and Registrar to Vice-Chancellor. Looking back, what are the most significant shifts you have witnessed in the purpose of higher education, and where do you believe engineering education stands in that transformation today?

When I look back over the last four decades, one of the most significant transformations I have witnessed is the changing purpose of higher education itself. Earlier, universities were primarily expected to impart disciplinary knowledge and prepare students for specific professions. While that responsibility remains important, the expectations from higher education today are far broader and more dynamic.

Universities are now expected to nurture innovators, entrepreneurs, leaders, ethical citizens, and lifelong learners who can contribute meaningfully to society. Knowledge alone is no longer sufficient. Students must also develop critical thinking abilities, adaptability, creativity, and a strong sense of social responsibility to navigate an increasingly complex world.



This shift is particularly visible in engineering education. Today's engineers are expected to solve multidisciplinary challenges that extend beyond technology and involve sustainability, economics, public policy, environmental concerns, and human behavior. The engineer of the future will not merely design products or systems; they will design solutions that address real societal needs. Therefore, engineering institutions must evolve from being centers that teach technologies to becoming ecosystems that nurture problem-solvers, innovators, and responsible change-makers capable of shaping a better future.

India's engineering institutions have traditionally measured success through placements. In an era dominated by AI, automation, and rapidly changing technologies, should engineering universities now be judged more by their ability to create innovators, researchers, and problem-solvers than by placement statistics alone?

Placements will always remain an important indicator because they reflect the employability and market relevance of graduates. However, in today's rapidly evolving technological landscape, they can no longer be the sole measure of institutional success.

Artificial Intelligence, automation, and emerging technologies are transforming industries at an unprecedented pace. Many routine technical tasks are increasingly being performed by intelligent systems, which mean that future professionals must bring capabilities that go beyond technical execution. Engineering institutions must therefore focus on producing graduates who can identify problems, think creatively, adapt continuously, and innovate throughout their careers.

The real measure of an engineering university today should include its ability to foster innovation, encourage research, support entrepreneurship, and develop professionals who remain relevant despite technological disruptions. Institutions should be assessed not only by how many students secure jobs but also by how many create solutions, generate intellectual property, launch startups, contribute to research, and address societal challenges.

Ultimately, placements indicate immediate success, whereas innovation capacity reflects long-term institutional impact. Universities must strive to achieve both.

Having led institutions through academic, administrative, and student-centric roles, what leadership qualities do you believe tomorrow's engineers will need that are currently missing from most engineering classrooms?

The future workplace is changing rapidly, and the leadership qualities required from engineers are evolving accordingly. While technical competence remains essential, it is no longer sufficient on its own.

Tomorrow's engineers will need adaptability, emotional intelligence, communication skills, resilience, ethical reasoning, and systems thinking. They will be expected to work in multidisciplinary teams, interact with diverse stakeholders, and make decisions in environments characterized by uncertainty and constant change.

Unfortunately, many engineering classrooms continue to focus heavily on technical content while giving comparatively less attention to these human and leadership dimensions. Students often graduate with strong theoretical knowledge but limited exposure to teamwork, communication, conflict resolution, and real-world decision-making.

Engineering education must therefore become more holistic. Institutions should create opportunities for project-based learning, collaborative problem-solving, leadership development, and community engagement. These experiences help students understand that successful engineering is not only about designing technologies but also about leading people, managing complexity, and creating positive societal impact.

You were part of academic teams that studied research cultures and university ecosystems in countries such as the USA, Canada, and Singapore. What is one practice you observed abroad that Indian engineering institutions still struggle to implement effectively, despite years of discussion around reform?

One practice that consistently impressed me in leading universities abroad was the seamless integration of academia, industry, and society. In many institutions across the United States, Canada, and Singapore, research often begins with a real-world challenge and progresses towards a practical solution that creates measurable impact.

The relationship between universities and industry in these ecosystems is not occasional or transactional. It is continuous, structured, and deeply embedded within the academic framework. Industry actively participates in curriculum design, research projects, innovation initiatives, internships, faculty development, and entrepreneurial ecosystems.

In India, we have certainly made progress in discussing and promoting industry-academia collaboration, but implementation remains uneven. In many cases, partnerships are still limited to placements or short-term interactions rather than sustained engagement.

For meaningful transformation, collaboration must become a routine part of institutional culture rather than a special initiative. When industry, academia, and society work together consistently, research becomes more relevant, students gain practical exposure, and innovation naturally flourishes. Until such integration becomes an integral part of our higher education ecosystem, many reform efforts will remain incomplete.

With AI increasingly capable of coding, designing, analysing data, and even generating research drafts, what should engineering students focus on mastering so that they remain relevant in a future where machines may perform many technical tasks faster than humans?

As Artificial Intelligence continues to evolve, it is becoming increasingly capable of performing tasks that were once considered exclusively human. However, there are still several qualities that machines cannot easily replicate, and these are precisely the areas where students should focus their attention.

Engineering students must cultivate creativity, curiosity, judgment, ethical reasoning, interdisciplinary thinking, and the ability to define meaningful problems. While AI can generate solutions, humans must determine which problems deserve solving, evaluate the broader implications of those solutions, and ensure that technological advancement remains aligned with societal values.

The future will belong not to those who simply use technology but to those who can combine technological capability with human insight. Students should learn how to work alongside AI rather than compete with it. They must understand how to leverage intelligent tools while retaining the ability to think critically, ask the right questions, and make responsible decisions.

In many ways, the rise of AI makes human qualities even more important. Technical knowledge will remain valuable, but the ability to apply that knowledge wisely and ethically will become the defining characteristic of successful professionals.

You have often emphasized academic quality, research exposure, and institutional excellence throughout your career. Many universities today have impressive research metrics on paper, yet very little real-world impact. How can engineering institutions bridge the gap between publication culture and problem-solving culture?

Research should never be viewed as an end in itself. In my view, meaningful research begins with a question that matters and ultimately leads to a solution that creates value for society. While publications are important because they contribute to the body of knowledge and academic discourse, they should not become the sole objective of research activity.

One of the challenges many institutions face today is that research is often evaluated primarily through quantitative indicators such as publication counts, citations, or rankings. While these metrics have their place, they do not always reflect real-world impact. Engineering institutions must therefore encourage outcome-oriented research that addresses pressing challenges related to industry, healthcare, sustainability, rural development, environmental protection, and societal well-being.

A strong problem-solving culture emerges when researchers engage directly with stakeholders and understand the practical realities surrounding a problem. When academia collaborates closely with industry, government agencies, communities, and civil society, research naturally becomes more relevant and impactful. Ultimately, the true success of research lies not merely in publication but in its ability to improve lives, solve problems, and contribute meaningfully to national development.

As someone associated with NAAC, NBA, AICTE, and UGC evaluation processes, do you think Indian institutions sometimes focus excessively on compliance and documentation rather than genuine academic transformation? What would an ideal quality-assessment framework look like from your perspective?

Quality assurance plays an important role in strengthening institutions, but there is always a risk that the process becomes more focused on compliance than on genuine transformation. In some cases, institutions invest considerable effort in producing documentation and evidence for assessment exercises rather than concentrating on creating meaningful educational value.

The purpose of any quality framework should be to improve learning outcomes, institutional effectiveness, research quality, innovation, and student development. Documentation is important because it provides evidence of processes and achievements, but it should never become the primary objective.

An ideal quality-assessment framework should encourage continuous improvement rather than periodic preparation for accreditation cycles. It should assess how effectively institutions create learning opportunities, support faculty development, foster innovation, engage with society, and prepare students for future challenges. Most importantly, it should reward authentic institutional growth rather than procedural compliance.

I have always believed that quality is not a file, a report, or an accreditation certificate. Quality is a culture. When institutions genuinely embrace excellence as part of their everyday functioning, meaningful transformation follows naturally.

Being based in Himachal Pradesh, do you believe engineering education in mountain states should evolve differently from institutions located in metropolitan regions? What unique research opportunities exist in areas such as sustainability, disaster management, climate resilience, infrastructure, and rural innovation?

I strongly believe that regional relevance should be a defining characteristic of higher education. While institutions everywhere must maintain global standards, they should also respond to the unique opportunities and challenges of the regions in which they operate.

Mountain states such as Himachal Pradesh offer exceptional possibilities for research and innovation. The region presents unique challenges related to climate resilience, sustainable infrastructure, renewable energy, water resource management, disaster mitigation, eco-tourism, smart agriculture, and rural development.



These are not only local concerns but increasingly global priorities as nations around the world confront issues related to sustainability and environmental change.

Engineering institutions located in such regions have an opportunity to become centres of excellence in these specialised domains. By addressing local challenges through technology and innovation, they can develop solutions with far-reaching applications beyond geographical boundaries.

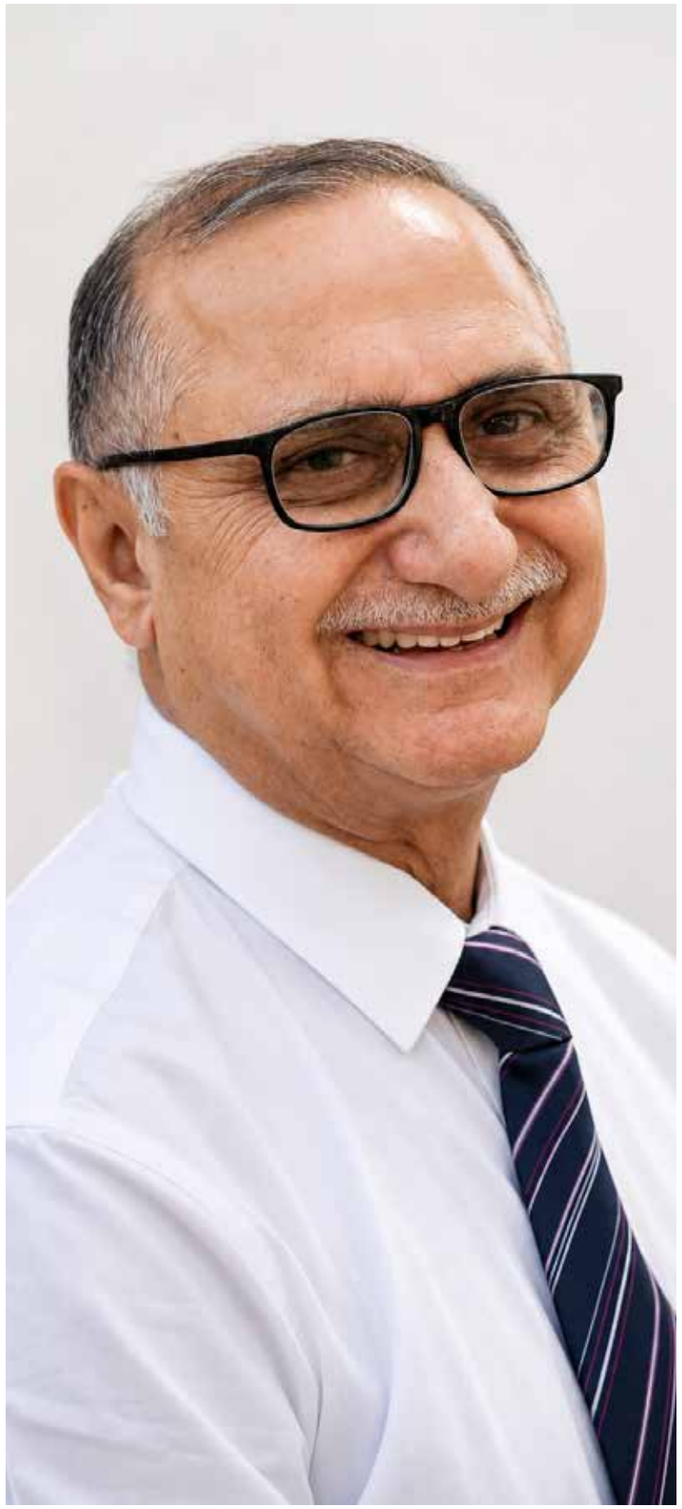
In many ways, mountain states provide ideal living laboratories where students and researchers can work on real-world problems. The objective should be to transform local challenges into globally relevant solutions while ensuring that development remains environmentally responsible and socially inclusive.

Your academic specialization is marketing, yet you have led multidisciplinary institutions and engineering-focused ecosystems. How has your understanding of consumer behavior and market dynamics influenced the way you think about engineering education and university governance?

Although my academic specialization is in marketing, I have always viewed marketing as much more than a business discipline. At its core, marketing is about understanding human needs, creating value, and responding effectively to changing expectations. These principles are equally relevant to higher education and engineering institutions.

Engineering solutions succeed only when they address genuine human requirements. A technically sophisticated innovation has little value if it does not solve a meaningful problem or improve the lives of people. My understanding of consumer behaviour has therefore reinforced the importance of keeping people at the centre of decision-making.

The same philosophy applies to university governance. Educational institutions serve multiple stakeholders, including students, parents, faculty members, industry partners, alumni, regulators, and society at large. Understanding their expectations helps institutions remain relevant, responsive, and future-oriented.



In many respects, successful university leadership requires the same mindset that successful organizations adopt—listening carefully, anticipating emerging needs, creating value, and continuously adapting to change. This perspective has significantly influenced the way I approach institutional development and academic leadership.

Many universities today have incubation centers, startup policies, innovation cells, and entrepreneurship clubs. However, very few student startups survive beyond the initial stage. What separates a genuine innovation ecosystem from a university that simply possesses innovation infrastructure?

Infrastructure is certainly important, but infrastructure alone does not create innovation. Many institutions today have incubation centres, startup policies, entrepreneurship cells, and innovation labs, yet relatively few are able to build a truly sustainable startup culture. The reason is simple: innovation is ultimately driven by culture rather than facilities.

A genuine innovation ecosystem encourages experimentation, curiosity, risk-taking, collaboration, and resilience. Students must feel empowered to explore ideas, learn from failure, and persist through uncertainty. This requires mentorship, industry engagement, access to networks, and institutional support that extends beyond the initial stages of a startup journey.

Innovation also flourishes when entrepreneurship is integrated into the broader academic environment rather than being treated as a separate activity. Faculty members, industry experts, alumni, investors, and institutional leaders all have important roles to play in nurturing entrepreneurial thinking.

The most successful ecosystems are those where innovation becomes part of the institutional mindset. When creativity, problem-solving, and value creation become embedded in the culture, infrastructure becomes an enabler rather than the defining factor. As I often say, infrastructure alone does not create innovation. Culture does.

As someone remembered for student engagement initiatives such as UMANG and HARMONY, you have consistently emphasized the cultural and human side of education. In an increasingly technology-driven world, how can engineering institutions ensure that students develop empathy, ethics, and social responsibility alongside technical expertise?

Technology has undoubtedly become one of the most powerful forces shaping our world, but technological advancement must always be guided by human values. If we focus exclusively on technical competence and overlook the human dimension of education, we risk creating solutions that may be efficient but not necessarily beneficial for society.

Throughout my academic journey, I have believed that education must contribute to the holistic development of individuals. Initiatives focused on student engagement, cultural activities, and community participation are important because they help students develop empathy, emotional maturity, social awareness, and a sense of responsibility towards others.

Engineering institutions must consciously integrate ethics, social responsibility, sustainability, and community engagement into the educational experience. These values should not be treated as peripheral subjects but as essential components of professional development. Students should have opportunities to work on real societal challenges, engage with diverse communities, and understand the broader implications of technological decisions.

Technology without humanity can create unintended and even chaotic consequences. Therefore, engineering education must remain deeply human-centred. The ultimate objective is not merely to produce technically competent engineers but responsible professionals who use their knowledge to improve society and contribute positively to the world around them.

One of the biggest concerns across higher education is not infrastructure but faculty preparedness. How should engineering institutions redesign faculty development so that professors can keep pace with AI, Industry 5.0, and rapidly evolving technological disciplines?

Faculty preparedness will be one of the most critical factors determining the future success of higher education institutions. No matter how advanced the infrastructure may be, the quality of education ultimately depends on the ability of faculty members to remain relevant in a rapidly changing environment.

Traditionally, faculty development has often been viewed as an occasional activity conducted through workshops or short training programmes. However, the pace of technological change today requires a fundamentally different approach. Faculty development must become continuous rather than periodic.

Professors should regularly engage with industry, participate in interdisciplinary research, collaborate internationally, and receive structured exposure to emerging technologies such as Artificial Intelligence, robotics, data science, advanced manufacturing, and Industry 5.0. Institutions must create ecosystems that encourage lifelong learning among faculty members just as strongly as they encourage it among students.

Equally important is the need to develop pedagogical innovation alongside technical expertise. Faculty members must learn how to integrate new technologies into teaching while fostering critical thinking, creativity, and problem-solving abilities among students. Ultimately, the future readiness of students depends directly upon the future readiness of faculty.

India produces one of the largest numbers of engineering graduates globally, yet industry leaders frequently raise concerns about employability and practical skills. In your assessment, where does the disconnect actually begin—in curriculum design, pedagogy, industry participation, assessment systems, or institutional mindset?

In my view, the disconnect is largely systemic rather than attributable to any single factor. Curriculum design, pedagogy, assessment methods, industry participation, and institutional mindset are all interconnected, and shortcomings in any one area can affect graduate outcomes.

One challenge is that curricula often evolve at a slower pace than technological advancements. By the time certain changes are implemented, industry requirements may have already shifted significantly. Similarly, pedagogical approaches sometimes continue to emphasize memorization and theoretical understanding rather than practical application, creativity, and problem-solving.

Assessment systems also deserve attention. In many cases, examinations reward the ability to recall information rather than the ability to apply knowledge in real-world situations. This creates a gap between academic performance and professional competence.

Industry engagement remains another critical area. Stronger collaboration between institutions and employers can help ensure that learning remains relevant and aligned with emerging workforce requirements.

Most importantly, however, we need a shift in mindset. Higher education must move from teaching subjects to developing competencies. When learning becomes experiential, interdisciplinary, industry-connected, and outcome-oriented, employability improves naturally because students graduate with the knowledge, skills, and adaptability required for long-term success.

The National Education Policy has strongly advocated multidisciplinary learning and flexible academic structures. From your experience implementing academic reforms, what are the biggest misconceptions institutions have about multidisciplinary education, particularly in engineering programs?

One of the most common misconceptions is that multidisciplinary education simply involves adding a few elective courses from other disciplines to an existing programme. While electives can certainly broaden exposure, true multidisciplinary learning goes much deeper than curriculum diversification alone.

The purpose of multidisciplinary education is to equip students with the ability to address complex problems that cannot be solved through a single disciplinary lens. Real-world challenges often require insights from engineering, management, social sciences, humanities, natural sciences, and public policy working together.

Achieving this objective requires thoughtful curriculum redesign, collaborative teaching, project-based learning, and flexible academic pathways that encourage students to integrate knowledge across domains. It also requires institutional cultures that promote collaboration rather than disciplinary silos.

At the same time, multidisciplinary education should not be confused with superficial breadth. Students must continue to develop strong disciplinary foundations while gaining broader perspectives. The objective is not breadth at the expense of depth. Rather, depth becomes more meaningful and effective when enriched by a wider understanding of the world and the interconnected challenges it presents.

Having served as a teacher, administrator, institution-builder, mentor, and now Vice-Chancellor, when future generations look back at your contribution to Indian higher education, what is the one change you would most like to be remembered for enabling?

Throughout my academic career, I have had the privilege of serving in a variety of roles, each of which has reinforced my belief that education is fundamentally about shaping people rather than merely awarding qualifications.

While institutions often focus on infrastructure, rankings, placements, and academic achievements, I have always felt that the true purpose of education extends beyond these measurable outcomes. Degrees are important, but they are only one aspect of a student's journey. The larger responsibility of education is to help individuals become responsible, ethical, competent, compassionate, and socially conscious human beings.

If future generations remember my contribution in any meaningful way, I would like it to be associated with advancing this broader vision of education. I would be happy if I am remembered as someone who consistently advocated academic excellence while also emphasizing values, character, inclusivity, and societal responsibility.

Ultimately, the success of an educational institution should be reflected not only in the careers its graduates build but also in the positive impact they create in society. If I have contributed, even in a small way, towards strengthening that vision, I would consider my academic journey truly meaningful.

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If you were tasked with designing a completely new engineering university for India in 2035—with no legacy constraints and complete freedom to innovate—what would be the first three things you would build differently from today's model?

If I had the opportunity to design an engineering university for 2035 without any legacy constraints, my primary objective would be to create an institution that is fundamentally aligned with the realities of the future rather than the traditions of the past.

First, I would establish a challenge-driven curriculum where learning revolves around solving real-world problems instead of studying isolated subjects. Students would learn by addressing complex issues related to sustainability, healthcare, technology, infrastructure, and societal development. Knowledge would be acquired through application rather than compartmentalized instruction.

Second, I would create a fully integrated industry-research-innovation ecosystem. Every student would participate in research, internships, entrepreneurial ventures, community projects, or innovation initiatives throughout their academic journey. The boundaries between classroom learning, research, and industry engagement would effectively disappear.

Third, I would build a human-centred educational framework where technology is inseparable from ethics, sustainability, leadership, and social responsibility. Technical excellence would remain important, but it would always be accompanied by a deep understanding of human values and societal impact.

The engineering university of 2035 should not simply produce engineers. It should produce innovators, leaders, entrepreneurs, and responsible global citizens capable of shaping a sustainable, inclusive, and prosperous future.

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HARDWARE COMES FIRST; **SOFTWARE MUST REFINE** WHAT WE BUILD

Dr Prateek Gupta
Assistant Professor, Applied Mechanics, IIT Delhi

As India pursues ambitious goals in semiconductors, advanced manufacturing, artificial intelligence, and deep-tech innovation, a crucial question remains: can technological independence be achieved without building strong foundations in hardware, materials, and core engineering sciences? In this thought-provoking conversation, **Dr. Prateek Gupta,** Assistant Professor in the Department of Applied Mechanics at IIT Delhi with Education Post's **Prabhav Anand,** offers a candid perspective on the realities of India's research and innovation ecosystem. Drawing on over a decade of experience in high-performance computing, computational fluid dynamics, and computational materials science—including research at Purdue University and ETH Zurich—he argues that simulations and software alone cannot deliver technological leadership. From semiconductor manufacturing and AI to research funding, academic incentives, and indigenous hardware development, Dr. Gupta presents a compelling case for reorienting India's innovation agenda toward building real engineering capability, robust experimental infrastructure, and globally competitive deep-tech ecosystems.

India is focusing a lot on becoming self-reliant in areas like semiconductors, advanced manufacturing, and energy technologies. In this journey, how important do you think computational engineering and high-performance computing are for building real technological independence?

Computational engineering is a tool in service of building technology and not the eventual destination. Manufacturing capability, experimental infrastructure, and the physical & empirical knowledge that comes from operating both are the pillars of real technological independence. I say this with some self-awareness. Computational research dominates Indian academia because experimental apparatus is perceived to be expensive and with limited access. I have spent most of my career doing computational work and only recently begun building experimental facilities. In some sense, that is a reasonable response to valid constraints also, not a chosen path.

It is important to highlight that this is a response to systemic constraints and not particularly economic constraints. However, computational research that matters and has an impact, is actually more expensive than experiments in India. A comparison I find clarifying is (based on my 5 year experience), one can build a decent compressible flow experimental facility (nothing large-scale as a real supersonic wind-tunnel) at a cost of 2-5 crores INR. A single compute node with out-of-date 128 processors costs around 20L INR from Indian resellers fitting Intel/AMD chips in so-called Indian compute nodes. In 5 crores, one would probably be able to purchase 15 such nodes with an additional >20L INR for the interconnect.

Rest of the cost would be required to setup environment conditioning for their optimum performance: dust collectors, precision Air conditioners, dehumidifiers. That amounts to around 2000 cores working together. Peanuts for a cluster! You could, at best, solve a boundary layer transition direct numerical simulation of a plate as long as, wait for it, 3 cm! So contrary to the popular belief, I think more bang-for-thebuck still rests with experimentalists in India. Of course, one can argue that we should purchase community computational clusters, and that brings down the cost per user. However, even then, due to annual maintenance charges, these things are expensive. Yet, we see more people (even I did in my initial stages) choosing computational research over experiments. The only way to reduce this gap and also to do computational research with impact is to build the hardware and use computations to solve refinement problems in hardware. If hardware is developed in India, then computational research will also be more accessible and research with more impact can be conducted.

Hardware comes first. After all, planes were flying well before computational fluid dynamics (CFD)! So to summarize, I think the road to technological leadership is through hardware and using software to refine hardware.

A major part of your research involves multiscale modeling and computational simulations. How can this kind of research help solve real industrial challenges in India, especially in sectors like semiconductors, energy systems, and advanced materials?

Multiscale simulation is most valuable when running ahead of a hardware program. It is useful in reducing experiments needed, identifying failure modes early, compressing development timelines. It becomes much less valuable when it is the program itself, because the hardware investment has not been made.

In semiconductors, we are doing electronic design automation. But process simulation such as modelling dopant diffusion, thin-film stress, etch profiles, etc is what allows a country to understand and improve a fabrication process. That layer of capability requires simulation tools and experimental process development facilities to validate against. One without the other produces knowledge that cannot be trusted in production.

The same logic applies across energy systems and advanced materials. Simulation validated only against other simulations is a closed system, internally consistent and potentially wrong about the world. There are many proposals upcoming encouraging industry and start-up engagement. There is increased intent to enable ease of research as well. It remains to be seen how it pans out. To summarize, computational research which is not being traced by hardware development is an empty run.

India produces a large amount of engineering research every year, but only a small part of it reaches industries or becomes real-world technology. According to you, what is stopping research from moving successfully from laboratories to the market?

This is a structural problem. Many like to blame academia, others like to blame industry. Both deserve some slack (or are maybe equally to blame, if blaming alone solves a problem!). The structural problem is a mismatch of timescales and incentives. Academic careers are evaluated on publications, which peak in value at Technology Readiness Level 3 (proof of concept). Industry needs TRL 7 or higher. The gap between them is expensive, slow, unglamorous work. We still like to gauge our researchers and their prestige as per "how



many international journal publications or citations have been garnered" not as per "how did this research help Indian industry". No one wants to recognize that doing something which has been done worldwide (take semiconductor manufacturing for example), in a place where it hasn't been done is also innovation. Homegrown solutions are sustainable and must be given proportional value. We like this idea in diet, but not in technology.

There is another more fundamental issue that rarely gets named. A significant fraction of Indian academic research, particularly the AI and ML work that now dominates publication counts, has not seen actual translation. A paper that benchmarks a model on foreign hardware, using a foreign framework, contributing to a foreign model ecosystem, is structurally disconnected India. The volume of such work is large. Its contribution to genuine technological independence is negligible.

We need products that work physically, engines, avionics, fabrication tools etc. Premier Indian institutions file patents at impressive rates, but we still fly aircrafts with engines and computers manufactured entirely abroad. The gap between IP creation and physical product is enormous and largely unaddressed. There are many steps being taken in the right direction (such as ANRF MAHA programs); what they need is longer grant durations, larger team sizes, IP protection, and success metrics that include deployment, not publications or patent filings alone.

Your work covers areas like compressible flows, nonlinear systems, and advanced computational methods. Do you feel India is investing enough in core engineering research, or are we becoming too focused on short-term technologies and trends?

India spends roughly 0.6–0.7% of GDP on R&D, flat for over a decade, while China crossed 2.5% and South Korea approaches 5%. The absolute amount has grown, but as a fraction of a growing economy, we have stood still.

Within that constrained envelope, the inclination toward AI and machine learning has become, I would argue, actively damaging. The dominant mode is not AI research, it is AI consumption. Students fine-tune existing models, run benchmark comparisons, and build applications on frameworks and hardware stacks built entirely outside India. This produces publications and well-paying industry roles, but it builds no sovereign capability. Mind you (the reader), these are industry roles for foreign industries. A graduate who has spent five years optimising on foreign GPU infrastructure is, at the end of it, a skilled user of technology India does not make and has no near-term path to making. That is not an engineer in any meaningful sense of the word.

What gets crowded out is the work that actually matters for hardware independence: fluid mechanics, materials science, thermodynamics, solid mechanics, the physical understanding that underpins every system India wants to build or manufacture. These fields take decades to build. When a strategic industrial window opens and the foundational knowledge base is not there, the opportunity passes and rebuilding it afterwards costs far more. We have seen this before. Picking immediate returns is not culture, by-the-way, it is basic arithmetic. Talented researchers make this choice because every one wants to be recognized. The system that rewards recognition on poor development is at fault.

Artificial Intelligence is now entering almost every field of engineering and scientific research. How do you see AI changing computational engineering and simulations in the coming years? Can AI speed up innovation, or are there risks in depending too much on it?

As the name suggests, it is Artificial intelligence. Most models are not inherently intelligent, they mimic intelligence – to the best of my knowledge. The bitter truth is, most tasks in our everyday life can be navigated through that mimicry. Personally, I have been using tools for coding for 6 months now, and for an avid coder who likes to learn by doing, and who does not have access to a large competent team (or actually even a single like-minded collaborator in computational sciences) who wants to devote time in actual scientific coding (I do not call "import numpy as np" in python as coding), the modern AI tools have been great for me. I got to learn good coding practices, efficient profiling of scientific codes, and so much more. However, unfortunately for me, that is where it stops, at least so far. These tools are great coding partners. Companies acing them deliberately made these tools to ace at coding, because that is the basic rule of civilization right? Become good at reproduction first. So a code generating good code is the best thing to do. Thinking that centuries of scientific knowledge gained over a time with unprecedented amounts of energy, can be done in a very short time scale by accelerating this reproduction, at the moment sounds like a pipe-dream to me. Think about the cumulative energy required to generate all scientific knowledge since – say – Newton. Do we really think that we can do that in a data center without damaging the environment? I would be very much interested in looking at such a calculation from a basic thermodynamics point of view. And if the numbers add up, why not? Ranting aside, AI can speed up development of tools. Current state-of-the-art requires an expert in the loop. Without an expert, these tools are dangerous because they sound like that friend at the bar who has no idea what they are talking about, but surely sounds confident!

Another more important point for India is this: the dominant mode of AI research in academia right now is consumption, not creation. PyTorch and TensorFlow run on NVIDIA GPUs, fabbed at TSMC on ASML machines — none of which India makes or has a credible path to making. Enthusiasm about AI research that runs entirely on this stack is, at its core, enthusiasm about becoming better users of foreign infrastructure. That is a legitimate economic activity but it is not technological independence. The AI research that would serve India's long-term interests is faster development of validated and verified scientific tools which aid in materials discovery, process optimization, and hardware design. The emerging photonic and neuromorphic computing paradigms (for example) might disrupt the GPU-dominated AI stack. Building toward those platforms, rather than continuing to optimise on foreign hardware, is where AI research and hardware ambition need to converge.

When people talk about India's semiconductor mission, the focus is mostly on manufacturing plants and investments. But how important are simulation, modeling, and computational research behind the scenes for building a strong semiconductor ecosystem?

The focus on fabs and plants is an absolutely right direction — they are the actual goal. The simulation question is about whether the manufacturing capability, once built, will be genuinely understood and owned, or merely operated on foreign knowledge. Process simulation is what allows a fab to develop new process nodes rather than only running licensed recipes. The1.60 lakh crore INR committed across approved ISM projects is serious hardware investment; the parallel

investment in the modelling capability that lets Indian engineers understand what happens inside those fabs is where the gap remains.

But the conversation that is almost entirely missing is raw materials. India imports approximately 90% of its rare earth compounds, overwhelmingly from China. For conventional silicon this is a known vulnerability. For next-generation hardware such as neuromorphic chips, the materials dependency might be even more acute, and domestic processing at electronics grade is essentially nonexistent.

The National Critical Mineral Mission and the rare earth permanent magnet scheme are a beginning. What is needed alongside them is a research program that treats materials processing as a first-class engineering science problem — using simulation to predict processing routes, optimise purification methods, and identify domestic substitutes — directly coupled to the extraction and processing pipeline. Simulation in service of building the materials supply chain, not as a substitute for it.

Through your work at IIT Delhi, you have been closely involved with advanced computational research. Looking ahead, which area do you think has the biggest potential for India in deep-tech innovation — advanced materials, energy systems, AI-driven simulations, or something else?

To be honest, I do not consider most of my work to be advanced computational research in the frontier sense. In fluids, I write codes that have been written worldwide, run on bigger machines, for more challenging problems. We like to use these codes to answer fundamental questions about fluid mechanics which remain un-answered. I do face skepticism from fellow researchers: why are you writing codes? What is the point? The point, to me, is twofold. First, to train the next generation of researchers who know how to build new open-source community solvers from scratch. Second, and more personally — solving a fluid mechanics problem through a solver you built yourself provides physical insights that are almost never accessible when the goal is simply to run someone else's code. Alas, I still have to do this on non-indigenous processors. In computational materials science, in collaboration with ETH Zürich, I did work that I think genuinely qualifies as advanced computational research. How that develops and gets accepted remains to be seen.

Only recently, I received a grant to build hardware for experimental testing, and I am quite excited about it. What many of my colleagues overlook is that hardware was my original love. I spent four years of my undergraduate degree in the workshop (alongside classes, of course) designing and manufacturing Formula Student race cars. But because my PhD was not with an experimentalist, so I am not a true experimentalist. In Indian academia, we let experience based labels to define the limits of what a trained engineer can learn (not)!

As far as the potential areas go, the most consequential opportunity is not a single technology domain but a full vertical, raw materials through processing, fabrication, and systems integration in an area where India has genuine assets and a closing strategic window. For instance, in semiconductors, the strategic logic could be the following: competing at advanced silicon nodes below 7 nm requires tens of billions of dollars and decades of accumulated process knowledge. That ship has sailed for new entrants. Photonics and neuromorphic computing are earlier in their development curve. A country that invests now in the full stack of such computing hardware has a realistic path to a leadership position. Research institutions in India have early activity in silicon photonics, but it currently depends entirely on foreign substrates and foreign fabs. Closing that dependency, starting with materials, is the work

Today, many students move away from core engineering research because they feel it offers fewer opportunities compared to corporate or software careers. In your opinion, how can India make deep-tech research more exciting, industry-connected, and rewarding for young engineers and researchers?

Students who leave for corporate careers are responding rationally to real incentives. A PhD in mechanical sciences (mechanics and associated fields), after five or six years, enters a faculty position at a salary that compares unfavourably with a mid-level software role. That is arithmetic, not culture.

But the AI and ML pull has made things worse in a specific way: it offers students the appearance of cutting-edge technical work while actually making them users of foreign platforms. The path of least resistance is to attach a neural network to any problem, publish on an international benchmark, and move into industry. It is

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unknown what they end up doing at these industrial jobs, which also, are not offered by Indian industry. This is individually rational and collectively damaging — it produces a large, skilled, substitutable workforce for companies whose critical technology decisions are made elsewhere.

There is another dimension that discourages capable researchers at every career stage, from staying in the system at all: merit is not reliably rewarded, and the gap between what is rewarded and what is meritorious tends to widen as careers progress. Academic positions, grant allocations, journal editorships, award nominations, and conference invitations in India are heavily shaped by who you know, which institutional/regional networks you belong to, and how faithfully you have maintained those affiliations, far more than by the quality of your work. A researcher who has chosen hard, independent problems, the kind that involve building things from scratch, working outside fashionable areas, producing results that lead to hardware development, consistently finds themselves at a structural disadvantage relative to peers who have invested more in network navigation than in the research itself. This is also a self-feeding cycle in many ways.

Making research careers genuinely attractive to the best people requires addressing this alongside the economic problem. Stronger fellowship stipends and structured industrial exposure matter. But none of it will retain researchers who have the ability to be elsewhere if the system continues to consistently reward connection over capability. Transparent, externally evaluated hiring and promotion, with meaningful representation from genuinely independent reviewers outside the immediate institutional network, and with accountability for research outcomes rather than output volumes, would change the incentive landscape considerably.

India wants to become a global technology and innovation leader in the next decade. What changes do you think are most important right now in India's engineering and research ecosystem to make that possible?

The problem is not a shortage of ideas but a shortage of honest diagnosis. Here is my honest diagnosis. We have all the tools, the intellectual power, the energy, and the most of all, availability of a vast and young demographic. We just need to be honest in directing its might.

The first thing to be honest about is what kind of independence we are building. Software and simulation running on foreign hardware, using foreign frameworks, validated against foreign experimental data, is a fragile form of self-reliance. We are producing, at large scale, a sophisticated user base for a technology stack we do not control. The semiconductor manufacturing opportunity of the 1990s is a useful reminder that strategic windows close, and catching up afterwards is disproportionately expensive. The window for photonic integrated circuits and neuromorphic computing (continuing my examples) is open now. That investment needs to start with raw materials.

The second honest assessment: Spending at 0.64–0.66% of GDP has not grown as a fraction of the economy in a decade. Calling a server indigenous when its processors are still foreign and its interconnect is at proof-of-concept stage is the kind of accounting that sounds good and changes nothing. A credible commitment to 2% of GDP in R&D, with a meaningful share going to physical infrastructure, experimental facilities, and genuinely indigenous hardware, would be a structural shift.

The third, and the most resistant to policy intervention, as discussed earlier, the ecosystem needs to become merit-based in practice, not just in principle. Advancement through institutional networks and affiliations rather than demonstrated capability is a self-reinforcing problem. Researchers doing hard, independent, hardware-oriented work face structural hurdles at every stage and eventually leave, while the system continues to reward network proximity over scientific output. Transparently evaluated processes with accountability for research outcomes rather than output volumes are not a luxury. These are prerequisites for everything else. We have to make the grass greener on this side. We must not be shy in recognizing and rewarding useful research which does not subscribe to the hype. Definition of "usefulness" should be anything which helps indigenous hardware development. I am pushing myself to do useful research against all hurdles, but usefulness is also about being open about the problems being faced. For instance, even if I want to, I cannot contribute to useful research in a lot of allied fields due to extreme gate-keeping, which prevents the right exposure.

I believe that only by re-orienting the priorities of young researchers towards product and hardware, we can sustain a computational research program in the long-term. Computations are supposed to help actual development, and not stop at simulations and proof-of-concepts.

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AI READY SCHOOL

THE SCARCE SKILL IS NO LONGER PRODUCTION **IT IS JUDGMENT**

Chiranjeevi Maddala
Co-founder and Executive Director
AI Ready School

As artificial intelligence reshapes industries and automates routine technical tasks, the future of engineering is undergoing a profound transformation. In this insightful conversation, ***Chiranjeevi Maddala,*** *Co-founder and Executive Director of AI Ready School, argues that the next generation of engineers must move beyond coding expertise to develop critical human capabilities such as problem-framing, systems thinking, creativity, and ethical judgment. He discusses with Education Post's* ***Prabhav Anand*** *about the growing importance of Agentic Thinking, the need to introduce AI, robotics, and space technologies at an early age, and why education must shift from rote learning to project-based, multidisciplinary problem-solving. Maddala also shares his vision for ensuring AI remains a tool that amplifies human intelligence rather than replacing independent thought.*

As artificial intelligence begins to automate many technical tasks, how do you see the role of engineers evolving over the next decade, and what skills will become most valuable?

The engineer of the next decade will spend far less time writing routine code and far more time deciding what is worth building and why. When AI can generate a function, a test, or a first pass design in seconds, the scarce skill is no longer production it is judgment. The engineer becomes an orchestrator: framing the problem, directing AI systems, and taking responsibility for the outcome.

I describe this shift as Agentic Thinking, the ability to delegate to intelligent systems while staying firmly in control of intent, quality, and consequences. The most valuable skills will be the ones AI cannot hold for you: problem framing, systems thinking, ethical reasoning, and the taste to know when an AI generated answer is good enough and when it is quietly wrong. Technical depth still matters, but it now sits on top of a layer of human agency. The engineers who thrive will be those who can move fluidly between deep specialisation and the bigger picture and who never outsource accountability to a machine.

India produces a large number of engineering graduates every year, yet industry often highlights a skills gap. What changes are needed in school and higher education to bridge this divide?

The gap is real, but it is not primarily a gap in knowledge, it is a gap in application. We test students on what they can recall, while industry needs people who can build, debug, collaborate, and adapt. A graduate who has memorised algorithms but has never shipped a working project arrives unprepared, no matter how high the marks.

Three changes matter most. First, learning must become project based and continuous rather than exam driven and terminal, students should leave with a portfolio, not just a transcript. Second, the curriculum has to update at the speed of the field; in AI, a syllabus that is three years old is already obsolete, which is why our programmes are refreshed monthly. Third, we must close the loop between learner and employer far earlier, so students build toward real expectations instead of discovering the gap on their first day at work. Bridging the divide is less about adding content and more about changing what we reward.

You often speak about a "Human First, AI Next" approach. How can engineering education use AI as a learning tool without weakening students' ability to think critically and solve problems independently?

"Human First, AI Next" is not a slogan, it is a sequence. The human does the thinking first; AI amplifies it second. The danger in education is that we invert this order and let students reach for the answer before they have wrestled with the question. When that happens, AI becomes a crutch instead of a catalyst.

The practical safeguard is to design AI tools that make students think rather than simply supply answers. In our own learning companion, the system is built to ask before it tells to prompt the learner to predict, explain, and reason before revealing a solution. Used this way, AI behaves like a demanding tutor who refuses to do your homework for you. The goal is to strengthen the muscle of independent thought, not replace it. If a tool leaves a student less capable when it is taken away, it has failed however impressive it looks in the moment.

Through MARS, you are exposing students to AI, robotics, and space technologies at an early stage. Why do you believe future engineering education should begin much before students enter college?

By the time most students reach an engineering college, their relationship with curiosity has often already been shaped and too frequently dulled by years of rote learning. Waiting until eighteen to introduce real problem-solving is like waiting until adulthood to teach a language. The window when the mind is most open to building, breaking, and wondering is far earlier.

MARS, our Mission for AI, Robotics and Space is built on the conviction that these are not advanced college subjects but natural extensions of childhood curiosity. A child who builds a small robot or trains a simple model in Grade 6 is not learning to be an engineer prematurely; they are learning that the world is something they can shape. Early exposure is not about producing specialists sooner. It is about preserving agency, confidence, and the habit of asking "why" and "what if," the foundations every great engineer is built on.

As AI, robotics, and data science increasingly intersect with traditional disciplines, do you think the future belongs to specialised engineers or multidisciplinary problem-solvers?

The future belongs to people who can do both, go deep in one domain while moving comfortably across many. The most interesting problems today

live at the intersections: AI meeting biology, robotics meeting agriculture, data science meeting public health. Pure specialists risk solving narrow problems beautifully while missing the larger system; pure generalists risk understanding everything at the surface and nothing deeply enough to build.

What I encourage is what I call T-shaped capability, genuine depth in a chosen discipline, sitting on a broad horizontal of literacy across adjacent fields. This is the heart of the Thinking 2.0 framework, which deliberately integrates computational thinking, design thinking, and agentic thinking rather than treating them as separate tracks. AI actually makes multidisciplinary more achievable, because it lowers the cost of working in an unfamiliar domain. The engineer of the future is not forced to choose between depth and breadth; they are expected to hold both.

Many educational institutions are introducing AI tools into classrooms. In your view, what separates meaningful AI integration from superficial adoption?

Superficial adoption asks, "How do we put AI into the classroom?" Meaningful integration asks, how do we use AI to deepen learning?" The difference shows up quickly. Superficial adoption is a chatbot bolted onto an existing process, used to generate worksheets faster or to give students quicker answers. It changes the tools but not the learning.

Meaningful integration changes the experience itself. It personalises the path for each learner, surfaces what a student actually understands rather than what they can reproduce, and frees teachers to do the deeply human work of mentoring. The test I apply is simple: does the AI make the student a more active thinker, or a more passive recipient? Does it give the teacher more insight and more time, or simply more dashboards? Technology in a classroom is only meaningful when it serves pedagogy. When the tool drives the pedagogy instead, you have adoption without transformation, motion without progress.

India aims to become a global technology and AI powerhouse. What is the biggest challenge currently holding back our future engineering talent, and how can the education system address it?

Our greatest challenge is not talent or ambition, India has both in abundance. It is a culture of learning that still rewards certainty over curiosity, and the right answer over the right question. We have built an education system superbly optimised for examinations and in doing so we have under-invested in creativity, risk-taking, and original problem-solving, the very traits an AI-driven economy demands.

The second challenge is access. World-class AI education cannot remain the privilege of a few metros while enormous talent in smaller cities and towns goes untapped. If we are serious about being a global AI powerhouse, we have to democratise this capability at scale.

Education addresses both by shifting from consumption to creation, and from scarcity to access. India does not lack people who can use AI, we must now produce people who can build with it, govern it, and apply it to our own civilization challenges. That is a deliberate national choice, and it begins in our classrooms.

In previous discussions, you have argued that students should not become passive consumers of AI-generated answers. What practical steps can educators take to ensure that AI enhances learning rather than creating dependency?

Dependency forms when the answer arrives before the effort. So the first practical step is to protect the struggle, design tasks where students must attempt, reason, and predict before any AI assistance is offered. The productive difficulty of thinking is where learning actually happens, and we must not let convenience erase it.

Second, make AI explain its reasoning, not just its conclusions, and require students to critique and verify what it produces. A learner who has to find the flaw in an AI answer is thinking harder than one who simply copies a correct one. Third, treat AI as a sparring partner rather than an oracle, use it to generate counter-arguments, alternative approaches, and questions, so the student stays in the driver's seat.

Finally, assess the process, not just the product. When we reward how a student reasoned, collaborated, and improved, rather than only the final output, AI naturally becomes a tool for thinking better, not a shortcut around thinking at all. Used with intent, AI can be the most powerful learning amplifier we have ever had. Used carelessly, it quietly hollows out the very capability we are trying to build. The choice, as always, is a human one.

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ENGINEERING MUST BUILD FOUNDATIONS, NOT CHASE EVERY TREND

Dr. Arya Kumar Bhattacharya
Dean, Research and Development
Ecole Centrale School of Engineering, Mahindra University

As engineering education undergoes a profound transformation in the age of artificial intelligence, automation, and cyber-physical systems, institutions are being challenged to rethink how they prepare students for an increasingly complex future. In this conversation, **Dr. Arya Kumar Bhattacharya,** Dean, Research and Development, Ecole Centrale School of Engineering, Mahindra University discusses with Education Post's **Prabhav Anand** about the evolving relationship between academia and industry, the growing importance of interdisciplinary research, and the need to move beyond knowledge creation toward innovation-driven outcomes. He also shares his perspectives on AI literacy, digital twins, sustainability challenges posed by emerging technologies, and the foundational role engineering education must continue to play in preparing graduates for long-term careers.

You have worked across defence, transportation, manufacturing, and academia. Looking at engineering education today, what are the biggest research habits that universities still fail to teach students, despite industry demanding them urgently?

Research and innovation are crucial aspects of higher education along with interdisciplinary problem-solving skills as they boost employability and global competitiveness. Students are often trained to solve well-defined problems rather than discover and define problems themselves. A proper foundation is significant for engineering students to prosper. Universities need to put more emphasis on evidence-based decision making. Research is about questioning assumptions, validating hypotheses and generating results. Universities need to train students to evaluate limitations and implications of the findings. Modern engineering students require interconnected ecosystems and they must view technology as a part of the same system.

A crucial aspect of research in industry is to search for and arrive at the root cause of any undesirable observations. This aspect is usually neglected in University / academia - based research, primarily because that is not a priority. From an early stage, we encourage students at Mahindra University to engage in inter-disciplinary projects and industry-linked research. In today's innovation-driven economy, this helps students to develop the knack of looking at issues from first principles and evaluate cause-and-effect relationships, develop curiosity and analytical rigour. We also offer global immersion programmes, that provide students opportunities to collaborate with world-class universities.

Much of your work focuses on AI-driven digital twins and the real-time replication of complex physical systems. As engineering moves toward cyber-physical ecosystems, do you believe traditional discipline-based engineering departments will eventually become obsolete?

From isolated physical machinery to dynamic cyber physical ecosystems, engineering is witnessing a shift called Industry 4.0 that is allowing systems to perceive, predict as well as autonomously adjust to real-world environments. The fundamentals of traditional engineering disciplines are indispensable; the change is the way they interact. Inherently multidisciplinary technologies include intelligent manufacturing, smart infrastructure, autonomous systems and digital twins, among many others. For instance, expertise in sensors, artificial intelligence, data analytics, control systems and domain specific engineering expertise is needed for developing a digital twin.

Flexible structures along with core disciplines enable collaboration across departments and universities must integrate disciplinary depth with interdisciplinary integration. We motivate our students to tackle challenges through critical thinking. Fuelled by experiential learning, students are empowered to become global thinkers.

Engineering institutions are rapidly adding AI and Machine Learning courses, but research output often remains disconnected from industrial deployment. What structural changes are required to transform engineering campuses from knowledge creators into innovation producers?

Many engineering campuses lack translational mechanisms which is one of the main reasons behind the disconnection. They do not have the systems required for moving discoveries from laboratories into practical deployment. The structural changes needed to transform engineering campuses from knowledge creators into innovation producers include stronger industry participation throughout research lifecycle, robust innovation infrastructure that supports technology and maturation, evolution of performance metrics. These together with patents, technology transfers, industrial collaborations, incubation of start-ups are a vital step in become innovation producers.

For knowledge creation, we actively encourage students and faculty members to pursue academic publications and intellectual property generation. To translate ideas into ventures and embed practice-led approach to entrepreneurship, Mahindra University's Atal Incubation Centre and Centre for Entrepreneurship and Innovation (CEI) cultivates research driven enterprise development. Further, many of our faculties have umbilical relations with industry, and this automatically accelerates translation of lab-level innovations to real applications for company bottom-line benefits.

Having filed more than twenty patents and spent years leading industrial R&D teams, what distinguishes research that gets published from research that actually changes how industries operate?

Impactful research and published research often service different objectives. Research that gets published usually contributes to new knowledge, advances comprehension and aids in building scientific foundation for future developments. Whereas research that alters the way industry operates addresses a clearly identified operational challenge. Within existing systems, it must showcase scalability, feasibility, ease of integration and economic feasibility. Every problem needs a solution and it must be efficient and must operate consistently.

When scientific rigor is combined with through understanding of operational realities that is when most

IN DEPTH **INTERVIEW**



innovations become successful and we are cultivating this mindset among our students and researchers. Through research dissemination and intellectual property, we are strengthening academic impact as well as innovation. 100 percent of our faculty members are Ph.D. holders; we have over 20 research teams and our research has been published in more than 500 publications.

An important factor to be kept in mind is that research that is published today will become impactful in a commercial sense, tomorrow. One may look upon this as the heights of fruits hanging from a tree. Low-hanging fruits are those than can be plucked and tasted maybe in six-months – these are like immediate industrial benefits. High-hanging fruits will gradually ripen and fall to be tasted much later or can be plucked with difficulty – these are like background research which is published today and will translate into advantages for the company after say 3 to 5 years. Mid-hanging fruits are in-between. There is an established global parlance for this: Technology Readiness Levels or TRLs. Levels 1-3 are basic research which may be published, 4-6 reflect mapping into real-world solutions (patents) and then 7 and above are actual commercialized applications.

Your research spans Game Theory, Evolutionary Algorithms, Autonomous Systems, and Industry 4.0. Which emerging engineering problem do you believe is currently being underestimated by researchers but will become critically important over the next decade?

The intersection of AI computational infrastructure with local environmental and resource constraints along with engineering of autonomous decision ecosystems are among challenges that are critically underestimated. With the surge in demand of water needed to cool AI data centres, there is a possibility that many developing countries might not be able to meet net-zero targets. In the future, individual AI models or autonomous agents will require interaction with large number of intelligent entities. To make coordinated decisions, fields such as distributed intelligence, optimisation, game theory and cyber physical systems are important.

Many engineering graduates are learning to use AI tools, but very few understand the mathematics, optimization, and system-level thinking behind them. Should engineering education prioritize AI literacy for all students or deep AI specialization for a smaller group? Why?

Both AI literacy and deep AI specialisation are important for educational institutions offering engineering courses. In today's hyper competitive environments, students need to possess basic understanding of how AI operates, its uses along with the mathematics, optimisation and the system-level thinking behind them. While AI acts as a foundation for competency, deep AI specialisation drives the next generation of breakthroughs. They need to create layered learning frameworks as engineers need to possess mathematical and computational depth needed to advance the field and be capable of working efficiently with AI enabled systems.

To cater to the growing demand for future-ready AI engineers, Mahindra University offers B. Tech in Artificial Intelligence which equips students to craft creative AI solutions for real-world problems and skilling them in machine learning and large-scale systems to transform industries and society. Our curriculum focuses on holistic development and we ensure that every single engineering graduate has a powerful foundation of computational thinking, mathematical modelling and optimisation.

We also run very specialized Elective Courses in AI that describe the mapping of these methodologies and perspectives into longer term advancements and applications. In a sense these Electives are taken by choice of students and only the best among them find place in these courses.

In an earlier interview, you emphasized the importance of interdisciplinary research, industry partnerships, and solving real-world challenges through collaboration. Several years later, what has surprised you most about the gap between academia's intentions and industry's expectations, and how should engineering institutions respond differently?

Academia and industry require better alignment of timeline, expectations and metrics as educational institutes traditionally operate on semesters, long term creation of knowledge and while industry operates on quarterly deliverables, immediate personal priorities and market pressure.

To bridge the gap between academia's intentions and industry's expectations, engineering institutions must learn to act as agile research partners for industry. They need blend theoretical knowledge with practical application. For translation of academic insights into industrial execution velocities, creation of dedicated interface layers are needed. Rather than occasional research partners, universities must position themselves as long term innovation partners.

We strategically partner with industry for development of curriculum, joint research facilities and internships. Few partnerships with Airbus, Rockwell Automation, Boltzmann Labs, National Academy of Construction, Dr. Reddy's, India Nippon Electricals Ltd, Tektronix, among others.

Having said this – industry also needs to understand that academic institutions create solid foundations of knowledge and understanding that span 3 to 4 decades of a student's potential lifetime career, and are not expected to tweak their teaching to attend to what may be a quasi-momentary priorities of different industries. They should not expect that academic institutions, especially the best ones, will keep modulating their curriculum to teach tools and techniques that may arise today and be outdated tomorrow. This is especially true of AI, ML and DL. Once the understanding matures on both sides (academia and industry), expectations will be more realistic and so the commensurate responses.



CONNECTING TALENT AND INDUSTRY WILL DEFINE **INDIA'S NEXT DECADE**

Dr. Gaurav Musalgaonkar
Researcher in Semiconductor Devices and Advanced Chip Technologies

As India accelerates its ambitions to become a global semiconductor and deep-tech powerhouse, the conversation around innovation is shifting from policy announcements to the engineering foundations that make technological self-reliance possible. In this insightful interaction with Education Post's Prabhav Anand, Dr. Gaurav Musalgaonkar, semiconductor researcher and device engineer, explores the opportunities and challenges shaping India's technological future. Drawing from his experience across academic research and the semiconductor industry, he discusses the evolution of next-generation transistor architectures, advances in image-sensing technologies, the growing role of AI-driven engineering, and the critical need to bridge the gap between research laboratories and real-world innovation. He also shares his perspective on India's semiconductor ambitions, deep-tech ecosystem, and the steps needed to make research careers more impactful, industry-connected, and aspirational for the next generation of engineers and innovators.

Through your research work, you have explored interdisciplinary and application-oriented engineering problems. What initially drew you toward this research direction, and how do you see its relevance in solving larger industrial and technological challenges in India today?

What drew me in was that semiconductor work never stays within one box. A single chip brings together physics, chemistry, materials, manufacturing, device design, and system-level application. To make real progress, you have to think across all of them.

My journey has reflected that. I started by working on silicon sensors for high-energy physics experiments, moved into CMOS/Infrared image sensors and imaging applications, and during my PhD worked on new transistor designs aimed at improving speed and power efficiency. These may look like different problems, but the common thread was always the same: taking an idea from theory or simulation and making it useful in a real technology context.

That is what kept me application-focused. I have always been most interested in work where simulations and models directly influence what can be built, whether in memory technology, advanced logic devices, or now power semiconductor products.

For India, this kind of research is especially relevant today. Semiconductors are now a national priority, and they are central to electric vehicles, renewable energy, defense, telecom, consumer electronics, and AI. Building a strong semiconductor base is not just about design or manufacturing alone; it requires connecting device physics, process technology, design, and reliability into solutions that work at scale. India already has a very strong engineering talent pool and a major role in global chip design. The next opportunity is to deepen capability across fabrication, packaging, and device technology, where hands-on, application-driven research can make a real difference.

A significant part of your research has focused on Tunnel FETs, nanowire architectures, and ultra-low power semiconductor devices. At a time when the global semiconductor industry is struggling with power efficiency and transistor scaling limits, how do you see these next-generation device architectures shaping the future of chip design and semiconductor innovation?

This is one of the central challenges facing the semiconductor industry. For decades, chips improved mainly by making transistors smaller. Today, the bigger limitation is power. Every transistor leaks some energy, and when billions of transistors are packed into a chip, that leakage and switching power become a major source of heat and energy consumption.

That is what drew me toward devices such as Tunnel FETs and nanowire architectures during my PhD. These devices explore ways to switch transistors using different physical mechanisms or more efficient device geometries, with the goal of reducing operating voltage and leakage. In simple terms, the aim is to do the same computation with much less energy.

I do not believe one new device will suddenly replace the conventional transistor everywhere. The semiconductor industry moves carefully because reliability, cost, and manufacturability matter as much as performance. What is more likely is that different devices will be used for the right applications: ultra-low-power devices for energy-sensitive functions, and more conventional devices where maximum performance is needed.

This is especially important in the AI era. We cannot keep solving computational demand only by building larger and hotter chips. The future will depend on getting more computation out of every unit of energy. That is why research into Tunnel FETs, nanowires, and other low-power architectures remains important, not just academically, but for the long-term sustainability of computing.

Your work on CMOS image sensors and HDR pixel technologies stands out because it combines device-level engineering with real-world imaging applications. What do you think are the biggest technological challenges today in improving image sensing systems, especially for applications like automotive electronics, medical imaging, and intelligent devices?

What I found most exciting about image sensors is that the physics is very direct. You are engineering how a device captures light and converts it into useful information. At the same time, the real-world requirements are becoming much more demanding.

One major challenge is dynamic range. For example, an automotive camera may have to detect objects while a car moves from a dark tunnel into bright sunlight. The sensor must capture both very dark and very bright parts of a scene without losing critical details. Achieving that inside a small pixel, without adding too much noise or cost, remains a difficult device-level challenge.

Another challenge is the trade-off between resolution and light sensitivity. Everyone wants smaller pixels and higher resolution, but smaller pixels collect less light, which can increase noise, especially in low-

light conditions. A lot of device engineering goes into managing this trade-off.

For applications such as automotive electronics, medical imaging, and intelligent devices, the sensor is no longer just taking a good picture. It is providing data for decisions, sometimes safety-critical or diagnostic decisions. That means sensors must be faster, more reliable, lower power, and more intelligent. I believe the next major advances will come from combining better pixel/device design with on-sensor processing and smarter imaging architectures.

One aspect that makes your profile particularly interesting is the balance between academic semiconductor research and practical industry-driven innovation, including your work related to high-voltage NAND technologies and device reliability. From your experience, what is the biggest difference between how semiconductor research is approached in academia versus how it is implemented inside the industry?

I have experienced both sides, and the biggest difference is the definition of success. In academia, the focus is often on proving a new idea, a novel device concept, or a mechanism that has not been demonstrated before. There is freedom to explore deeply and ask how far a concept can be pushed in principle.

Industry asks a different question. A good idea is only the starting point. The real test is whether it can be manufactured reliably, repeatedly, and economically at scale. When I moved into NAND and DRAM memory and device reliability work, I saw very clearly that an elegant device solution is not enough if it cannot survive real processing, meet reliability targets, or support high yield.

So, academia often asks, 'Is it possible?' Industry asks, 'Is it possible, repeatable, reliable, affordable, and scalable?'

Both are essential. Academia creates bold ideas and new directions, while industry brings the discipline needed to turn those ideas into products. I believe the most impactful work happens when researchers can understand both worlds and bridge the gap between scientific novelty and practical implementation.

India is currently focusing heavily on building a stronger innovation and startup ecosystem. Based on your own research journey, do you think Indian institutions today are providing enough support for researchers who want to translate academic work into scalable technologies or industry-led solutions?

India has come a long way, and the intent today is much stronger than before. The talent and quality of fundamental research in Indian institutions have always been strong. What has improved recently is the national ambition around innovation, deep tech, and semiconductor development.

We are also seeing more industry investment, with semiconductor manufacturing, assembly, packaging, design, and R&D activity expanding in India. This matters because academic research needs a real destination: facilities, industry problems, and partners who can help move ideas closer to production.

The gap that still remains is translation. Moving from a promising lab result to a scalable product is difficult, especially in semiconductor technology, where the required infrastructure is expensive and the development cycle is long. A strong idea can stall if there is no clear path to prototyping, fabrication access, patient capital, or industry partnership.

So my view is that the foundation is being laid and the direction is right, but the ecosystem is still maturing. What needs to grow further is the connective tissue between academia, industry, investors, and manufacturing infrastructure. If India can strengthen those bridges, many more research ideas can move from papers into real technologies and companies.

In your field, computational and technology-driven approaches are becoming increasingly important across engineering and scientific research. How do you see emerging technologies like AI, simulation tools, and advanced computing changing the future of engineering research in India?

This is something I am very excited about because it is changing how engineering work is done. In semiconductor development, simulation has always been central. Before building a chip or device, we model it, test design options virtually, and eliminate

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AI is now adding another layer of acceleration. In my own work, I have built AI-based tools to automate repetitive engineering tasks and explore large design spaces more efficiently. This allows engineers to spend less time on routine extraction and more time on deeper technical decisions.

For India, this is especially important because computation can lower the barrier to high-quality research. Not every institution can immediately access a full semiconductor fabrication facility, but many researchers can use simulation, AI, and advanced computing to develop strong ideas, optimize devices, and build valuable capability.

At the same time, computation cannot replace hardware completely. Fabs, labs, measurements, and hands-on process knowledge are still essential. The real opportunity is to combine India's software strength and engineering talent with better access to simulation tools, computing infrastructure, and industry-relevant training. That combination can make engineering research faster, more practical, and more globally competitive.

Looking at your own work and the broader research ecosystem, what are some areas where you believe India has strong potential to emerge as a global leader in deep-tech and applied engineering research over the next decade?

I would answer this from where I sit, having worked across both Indian academic research and the U.S. semiconductor industry. I believe India's strongest opportunities are in areas where deep engineering meets large real-world needs.

Space and defense are clear examples. India has already shown that it can deliver complex engineering outcomes with remarkable cost efficiency, and the growth of private space companies can make this sector even stronger.

Semiconductors are another major area. India already has strong design talent, and the current national focus on semiconductor manufacturing, packaging, and design is an important step. Manufacturing will take time to mature, but India can become highly competitive in chip design, AI-driven design automation, packaging, and application-specific semiconductor solutions.

Clean energy and storage are also promising because India's energy needs are massive, and the country has strong motivation to develop scalable and affordable solutions.

Overall, I see India's biggest deep-tech opportunity in combining software strength, engineering talent, and large domestic demand. The next decade will depend on how well India connects talent, capital, industry partnerships, and long-term patience into finished technologies.

Young researchers today often feel that core scientific and engineering research is intellectually rewarding but professionally uncertain. Based on your own academic and research experience, what changes are needed to make research careers more impactful, industry-connected, and aspirational for students in India?

This is a real concern, and I felt some of it myself. Core research is intellectually rewarding, but young researchers are not wrong to worry about career uncertainty. The work is long, the outcome is not always predictable, and students can sometimes feel they are falling behind peers who choose more direct industry paths.

The biggest change needed is a stronger connection between research and industry. Students are more motivated when they can see a clear line from the lab to a real product, company, or societal problem. This means more industry collaborations, more PhD internships inside companies, more joint projects, and more faculty-industry interaction.

The second change is financial stability. Research careers should be made more viable through better fellowships, competitive stipends, clearer career tracks, and stronger support during the most demanding years of training.

The third is better support for translation. Many good research ideas never move beyond publication because researchers lack access to prototyping, patent commercialization support, startup funding, or patient capital. Stronger mechanisms for spin-offs and deep-tech startups would make research feel like a launchpad rather than a dead end.

Finally, research needs more visibility and respect in the public imagination. We celebrate entrepreneurs and engineers, but we should also celebrate scientists and researchers who build deep technologies. When students see such people as role models, research becomes not a sacrifice, but an ambitious and impactful career choice. EP

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THE FUTURE BELONGS TO THOSE WHO CAN **COLLABORATE INTELLIGENTLY WITH AI**

Dr. Rekha Kashyap
Dean, CSE (AI & ML), KIET University

As Artificial Intelligence continues to redefine industries, the role of engineering institutions is evolving from knowledge providers to innovation enablers. In this conversation, ***Dr. Rekha Kashyap,*** *Dean, CSE (AI) & CSE (AI & ML), KIET University, shares her perspective with Euducation Post's* ***Prabhav Anand*** *on building an AI-first academic ecosystem that goes beyond classroom learning. She discusses the importance of strong fundamentals, industry integration, project-based learning, and responsible use of AI tools in education. Dr. Kashyap also highlights the growing need for problem-solving, adaptability, and communication skills among engineering graduates while emphasizing the value of research, open-source contributions, entrepreneurship, and interdisciplinary learning. Looking ahead, she envisions a shift towards intelligence-based education, where critical thinking, innovation, and real-world experiences will define the future of engineering and prepare students for an increasingly AI-driven world.*

Many engineering colleges have introduced AI and Machine Learning programs, but very few have been able to create a complete AI ecosystem around them. At KIET, what have been the biggest challenges in moving from simply teaching AI as a subject to making it a culture of innovation and problem-solving?

One of the biggest challenges was changing the mindset from "learning AI" to "living AI." In many institutions, AI remains confined to classrooms, assignments, or isolated projects. At KIET, our vision was to make AI part of the academic culture, research ecosystem, industry engagement, and student innovation journey.

The first challenge was faculty readiness. AI evolves rapidly, so continuous faculty development became essential. We encouraged faculty members not only to teach AI, but also to engage in research, certifications, industry collaboration, and interdisciplinary innovation.

The second challenge was creating the right infrastructure. AI education cannot be effective without computational resources and exposure to real-world environments. Establishing the NVIDIA DGX A100 powered Centre of Excellence helped us provide students and researchers access to advanced AI computing infrastructure similar to what is used in industry and research labs.

Another important challenge was breaking the traditional separation between theory and practice. At KIET, we consciously built a teaching-learning environment where there is minimal demarcation between classrooms and laboratories. Students work on datasets, projects, hackathons, research problems, and industry use cases alongside theoretical learning.

We also realized very early that AI education cannot remain limited to coding alone. AI is transforming healthcare, finance, agriculture, manufacturing, and education itself. Therefore, we shifted toward interdisciplinary problem-solving where students understand both technology and the domain in which it is applied.

Finally, innovation culture develops only when students feel encouraged to experiment and take ownership of ideas. We actively promote hackathons, open-source participation, startup initiatives, research groups, and industry collaborations so that students begin to see AI not merely as a subject, but as a tool to solve meaningful real-world problems.

The AI industry is evolving so quickly that what students learn in their first year may become outdated by the time they graduate. How do you ensure that the curriculum remains relevant without constantly chasing every new trend that appears in the market?

This is one of the most important questions in engineering education today. If institutions start chasing every new trend, the curriculum becomes unstable and fragmented. Our approach at KIET is to build strong foundations first and then layer emerging technologies on top of them.

Core computer science fundamentals such as programming, algorithms, operating systems, databases, mathematics, and computational thinking remain timeless. A student with strong fundamentals can adapt to future technology shifts, whether it is generative AI, agentic AI, quantum computing, or technologies we have not yet imagined.

At the same time, curriculum today cannot remain static. AI has forced higher education to become more dynamic and industry-responsive. Autonomy gave us the flexibility to continuously evolve the curriculum in alignment with industry requirements.

At KIET, industry integration starts early. In the autonomous batch, industry exposure begins from the third semester, while in the university batch we introduced it from the first semester itself. We embedded certifications in cloud computing, data analytics, and machine learning directly into the credit structure, significantly improving student participation and outcomes.

Instead of redesigning the curriculum every few months, we focus on creating lifelong learners. In AI, tools and frameworks may change rapidly, but analytical thinking, problem-solving ability, adaptability, and learning agility remain constant.

The objective is not to prepare students only for today's technologies, but to prepare them for continuous evolution throughout their careers.

There is a growing concern that students are becoming highly dependent on AI tools for coding, assignments, and even learning itself. As an academic leader, where do you draw the line between using AI as a learning assistant and becoming overly dependent on it?

AI is a powerful assistant, but it should never replace thinking. I believe the real question is not whether students should use AI tools, because industry itself is becoming increasingly AI-driven. The real concern is whether students understand what the AI is generating and whether they can critically evaluate it.

Today, there is a growing "specification-to-code" mindset where students believe AI can generate complete solutions automatically. However, without strong fundamentals, students cannot debug intelligently, validate outputs, or identify flawed logic. They may continue modifying prompts without truly understanding the underlying system.

At KIET, we encourage responsible AI usage. Students are allowed to use AI for ideation, debugging support, productivity enhancement, and research assistance. However, they are also expected to explain their logic, justify their decisions, and demonstrate conceptual clarity.

Our assessment philosophy has evolved accordingly. For development-oriented subjects, we increasingly use project-based evaluations, code walkthroughs, viva discussions, implementation-based assessments, and hackathons. In several AI and machine learning subjects, students also participate in Kaggle competitions and real-world problem-solving exercises.

The future belongs not to those who avoid AI, but to those who can collaborate intelligently with AI while



retaining independent thinking, creativity, and ethical judgment.

One interesting aspect of your department is the focus on emerging areas such as blockchain, cloud technologies, computer vision, and agentic AI alongside traditional engineering fundamentals. How do you balance teaching core computer science concepts with these rapidly emerging technologies?

We view emerging technologies as applications of strong fundamentals rather than replacements for them.

For example, students cannot build scalable AI systems without understanding operating systems, databases, networking, software engineering, and distributed computing. Similarly, blockchain relies heavily on cryptography and distributed systems, while computer vision depends on mathematics, algorithms, and machine learning foundations.

Therefore, our philosophy is "fundamentals first, innovation next."

The early stages of the curriculum focus on computational thinking and core engineering principles. As students progress, they begin applying those concepts to emerging domains through electives, labs, projects, research, and industry-integrated learning experiences.

We also strongly emphasize interdisciplinary learning. AI today is impacting healthcare, finance, agriculture, manufacturing, and education. Engineers create meaningful impact when they combine technical expertise with domain understanding.

Our objective is not to overload students with every new technology trend, but to develop engineers who possess strong foundations, adaptability, and the ability to learn continuously.

Industry leaders often say that engineering graduates possess theoretical knowledge but struggle with real-world problem solving. From your interactions with recruiters and technology companies, what are the three skills that today's engineering students are still missing despite the AI boom?

From my interactions with industry leaders, I believe three major gaps still exist.

The first is problem-solving ability. Many students understand concepts theoretically but struggle to apply them to open-ended real-world challenges where there are no predefined solutions.

The second gap is communication and collaboration. Modern engineering is highly interdisciplinary and team-driven. Students who can communicate ideas effectively, work collaboratively, and present solutions clearly stand

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out significantly during placements.

The third gap is adaptability and self-learning. Technology is evolving faster than ever before, and companies increasingly value engineers who can continuously learn, explore new technologies independently, and adapt quickly to changing environments.

At KIET, we try to bridge these gaps through project-based learning, interdisciplinary exposure, hackathons, open-source participation, research initiatives, and industry-aligned certifications. This year alone, our students made nearly 1,500 contributions on open-source platforms like GirlScript Summer of Code along with multiple Google Summer of Code contributions. More than 2,000 students also earned global certifications aligned with industry needs.

Technical skills remain important, but increasingly, industry is looking for engineers who combine technical competence with innovation mindset, professionalism, communication skills, and learning agility.

A student from KIET recently credited you for introducing him to blockchain ecosystems and supporting his entrepreneurial journey. Many institutions talk about innovation, but few actively support unconventional student paths. How can engineering colleges create an environment where students feel encouraged to build products, startups, and research projects while still pursuing their academics?

Innovation grows when institutions create trust-based ecosystems rather than fear-based academic environments.

Students should feel encouraged to experiment, explore unconventional ideas, and even fail during the learning process. At KIET, we try to provide mentorship, infrastructure, research opportunities, industry exposure, and academic flexibility for students pursuing innovation-oriented paths.

We actively encourage participation in hackathons, startup competitions, open-source communities, patent initiatives, and collaborative research groups. Students working on serious ideas are connected with faculty mentors, industry experts, and technical communities that help them refine and scale their work.

One of the most important changes we introduced was integrating innovation into academics instead of treating it as an extracurricular activity. Capstone projects, interdisciplinary labs, certifications, and industry-linked projects are aligned with the academic structure itself.

I strongly believe engineering institutions should not only prepare students for jobs, but also empower them to become innovators, researchers, entrepreneurs, and creators of technology.

When students are trusted with responsibility, resources, and mentorship, they often exceed expectations.

Looking ahead to the next five years, what major transformation do you foresee in engineering education because of AI? More importantly, what is the one change that engineering institutions should start implementing today if they do not want to become irrelevant in the future?

The biggest transformation will be the shift from information-based education to intelligence-based education.

Earlier, institutions focused primarily on delivering information. But in the age of AI, information is instantly accessible. The role of universities will increasingly shift toward developing higher-order capabilities such as critical thinking, creativity, ethical reasoning, interdisciplinary problem-solving, innovation, and leadership.

AI will also significantly personalize learning. Adaptive learning systems, AI tutors, intelligent assessment platforms, simulation-driven education, and skill analytics will reshape how students learn and how institutions evaluate learning outcomes.

Assessment itself is undergoing major transformation. Traditional theory-heavy examinations alone are no longer sufficient for many technology subjects. At KIET, we are increasingly moving toward project-oriented assessments, hackathon-based evaluations, open-source participation, Kaggle competitions, and implementation-driven learning models.

However, the most important change institutions must implement today is integrating industry, research, and experiential learning deeply into the curriculum from the early semesters.

Traditional static education models are becoming obsolete. Students must work on real-world projects, emerging technologies, interdisciplinary challenges, and innovation ecosystems continuously throughout their academic journey.

The institutions that will remain relevant in the future are those that can successfully combine academic rigor, technological adaptability, ethical responsibility, industry integration, and innovation culture into one unified educational ecosystem. EP

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CYBERSECURITY IS NO LONGER A NICHE SPECIALISATION

IT IS A FOUNDATIONAL PILLAR OF THE DIGITAL ECONOMY

Prof Dr Sanjay Chordiya
Chairman & Dean Academics,
Suryadatta Education Foundation's Suryadatta International Institute of Cyber Security (SIICS), Pune

*As India accelerates its journey toward a digitally empowered economy, cybersecurity has emerged as one of the defining challenges of our time. From AI-powered cyber threats and digital frauds to the growing demand for skilled professionals, the landscape is evolving faster than ever. In this conversation, Chairman & Dean Academics, Suryadatta Education Foundation's Suryadatta International Institute of Cyber Security (SIICS), shares his insights on the future of cybersecurity, the transformative role of Artificial Intelligence, and the critical need for cyber awareness across society with Education Post's **Prabhav Anand**. He also discusses how educational institutions must bridge the gap between academic learning and industry expectations while nurturing ethical, future-ready professionals capable of safeguarding the digital world.*

Cybersecurity has moved far beyond protecting computer systems and is now a critical concern for governments, businesses, financial institutions, and even individual citizens. In your view, what are the biggest misconceptions people still have about cybersecurity in today's hyper-connected world?

One of the biggest misconceptions is that cybersecurity is purely a technology issue handled by IT departments. In reality, cybersecurity is a shared responsibility involving individuals, organisations, and educational institutions. Another misconception is that only large companies are targeted by cybercriminals. Today, small businesses, educational institutions, healthcare organisations, and even individual citizens are becoming victims of online fraud and cybercrime.

Cybersecurity is not just about technology; it is about awareness, responsible behaviour, and safe digital practices. In a hyper-connected world, cybersecurity is no longer optional—it is a fundamental necessity for economic growth, national security, and personal safety.

The rise of Generative AI has created a double-edged sword, empowering both cyber defenders and cybercriminals. How do you see AI reshaping the cybersecurity landscape over the next five years, and are educational institutions adapting quickly enough to this shift?

Artificial Intelligence will transform cybersecurity in profound ways. AI-powered tools can detect anomalies, predict threats, automate incident response, and significantly reduce reaction times. At the same time, cybercriminals are increasingly using AI for phishing attacks, malware generation, social engineering, and deepfake-based fraud.

Over the next five years, cybersecurity professionals will need expertise not only in security technologies but also in AI governance, AI risk management, and AI-assisted threat detection.

Educational institutions must continuously update their curriculum to keep pace with these changes. At SIICS, we focus on industry-oriented learning, practical exposure, and emerging technologies such as AI, Data Science, and Cyber Security so that students remain future-ready.

Cyberattacks today are increasingly targeting human behaviour rather than technological vulnerabilities alone. Do you believe cyber awareness and digital hygiene should become a core life skill, much like financial literacy, and how can institutions contribute to building that culture?

Absolutely, Cyber awareness has become as important as financial literacy. Every individual today uses digital banking, social media, cloud platforms, online education, and digital communication tools. Simple practices such as using strong passwords, avoiding suspicious links, and protecting personal information can prevent many cyber incidents..

Educational institutions can play an important role by creating awareness among students and helping them become responsible digital citizens. At SIICS, we emphasise not only technical knowledge but also cyber hygiene practices, responsible digital behavior, ethical technology usage, and awareness of emerging cyber threats.

We believe cybersecurity education should start at the school level and continue throughout higher education and professional development. We regularly organise cybersecurity seminars, conclaves, and awareness campaigns for students, professionals, senior citizens, homemakers, and the wider community. Our objective is to ensure that every individual, irrespective of age or profession, is equipped to navigate the digital world safely and responsibly.

Creating a cyber-aware society is not merely a technological objective; it is a social responsibility.

India's rapid digital transformation through platforms such as digital payments, e-governance services, cloud infrastructure, and smart technologies has created immense opportunities. At the same time, it has expanded the threat surface. What do you consider India's most pressing cybersecurity challenges today?

India's digital transformation has been remarkable, with initiatives in digital payments, e-governance, smart cities, and digital public infrastructure. However, this rapid growth has expanded the attack surface significantly.

Some of the key challenges include rising cyber frauds and financial scams, shortage of skilled cybersecurity professionals, data privacy and protection concerns, cybersecurity preparedness among organisations and citizens.

India must continue strengthening cyber resilience through policy frameworks, industry collaboration, public awareness initiatives, and talent development..

Despite a growing demand for cybersecurity professionals worldwide, employers often report a shortage of job-ready talent. What specific gaps do you observe between what learners are taught and what the cybersecurity industry actually requires?

The industry often seeks professionals who can immediately contribute to real-world security operations. However, many learners graduate with theoretical knowledge but limited exposure to practical environments.

The major gaps include: hands-on experience with security tools and platforms; exposure to real-world cyber incidents and case studies; communication, teamwork, and problem-solving capabilities; Industry-recognized certifications and practical competencies.

At SIICS, we address these gaps through industry projects, cyber labs, internships, expert sessions, certification pathways, hackathons, and experiential learning.

Ethical hacking, digital forensics, threat intelligence, and cyber surveillance are powerful capabilities that can be used for both protection and misuse. How do institutions like SIICS ensure that students develop not only technical expertise but also a strong sense of ethics and responsibility?

Cybersecurity professionals often have access to sensitive systems and critical information. Therefore, ethics is as important as technical competence.

At SIICS, ethical responsibility is embedded throughout the learning process. Students are introduced to professional ethics, legal frameworks, cyber laws, responsible disclosure practices, and the societal impact of technology.

We encourage students to use their skills for protection, innovation, and nation-building. Through ethical hacking labs, cybersecurity competitions, industry interactions, and case-study-based discussions, students learn that technology must always be guided by integrity, accountability, and professionalism.

SIICS has been actively promoting specialised learning in Cyber Security, Artificial Intelligence, Data Science, and Digital Technologies. Looking ahead, which emerging domains—such as quantum security, AI governance, cyber warfare, or digital trust—do you believe will create the next wave of career opportunities for students and professionals?

The future will create exciting opportunities in areas such as:

- AI Security and AI Governance
- Quantum Security
- Cloud Security
- Cyber Threat Intelligence
- Data Governance
- Zero Trust Architecture
- Digital Trust and Risk Management

Organisations worldwide are looking for professionals who can secure emerging technologies while ensuring compliance, privacy, and resilience.

At SIICS and the Suryadatta Group of Institutes, our focus is on preparing students not just for today's careers but for the jobs and challenges of the next decade. We believe the future belongs to professionals who combine technological expertise, ethical judgment, innovation, and adaptability.

Conclusion:

"Cybersecurity is no longer a niche specialisation—it is a foundational pillar of the digital economy. At SIICS, our mission is to nurture competent, ethical, and future-ready cyber professionals who can contribute meaningfully to industry, society, and national security." EP





WE ESSENTIALLY CREATE **AI OPERATORS, NOT AI SYSTEM BUILDERS**

Prof. Nishit Narang
Professor& Head of Department
Department of Computer Science & Information Systems, BITS Pilani

You have worked across terrestrial, satellite, mobile communication systems, and Industrial IoT before entering academia. Looking at today's engineering graduates, which fundamental networking or communication concepts do you believe are being overlooked despite becoming even more critical in the age of AI, edge computing, and connected devices?

What I see increasingly being overlooked are the first principles of communication systems and distributed networks—ironically at a time when they matter the most.

Students today are comfortable using APIs and cloud services, but often lack depth in latency, bandwidth, and QoS trade-offs; network protocols beyond the application layer; distributed systems behaviour under failure; wireless constraints such as interference, spectrum, and reliability; and edge vs cloud consistency models.

In AI and edge computing, the system is only as intelligent as its weakest communication link. For example, in Industrial IoT or autonomous systems, decisions are time-sensitive—milliseconds of delay or packet loss can degrade AI outcomes significantly.

So, the gap is not lack of tools—but the lack of a systems-oriented thinking about how data moves, degrades, and synchronizes across networks.

Engineering institutions are rushing to introduce AI-focused programs, yet the world's digital infrastructure still runs on communication networks, embedded systems, and cybersecurity. Do you think universities risk producing AI users rather than engineers who understand the underlying systems that make AI possible?

Yes, this is a very real risk. Many programs focus on using AI frameworks—but not on how data is generated, transported, secured, and governed; how compute is distributed across edge, cloud, and devices; and how systems are scaled and made fault-tolerant.

AI does not exist in isolation—it is an overlay on top of complex infrastructure, including networks, distributed systems, embedded platforms, and security layers. If we neglect these, we essentially create AI operators, not AI system builders.

From an engineering standpoint, universities must ensure that AI is taught as a systems discipline, not just as a modelling or coding exercise.

As engineering education rapidly embraces artificial intelligence, a crucial question emerges: are institutions creating true system builders or merely producing technology users? In this conversation, Prof. **Nishit Narang,** Professor and Head of Department, Department of Computer Science & Information Systems, BITS Pilani with Education Post's **Prabhav Anand** explores the foundational engineering principles that risk being overshadowed in the AI era. From communication networks, distributed systems, and cybersecurity to Industrial IoT, semiconductor innovation, and Industry 4.0, he highlights the critical challenges shaping the future of connected technologies. Narang also discusses the widening gap between academic learning and real-world engineering, emphasizing security-by-design, systems thinking, and interdisciplinary integration. His insights offer a compelling roadmap for building resilient, scalable, and future-ready engineering ecosystems capable of driving India's technological leadership in the decades ahead.

The next decade will witness billions of interconnected devices across smart cities, manufacturing, healthcare, and mobility ecosystems. From an engineering perspective, what are the biggest unsolved challenges in designing networks that are simultaneously intelligent, scalable, energy-efficient, and secure?

Designing networks that are simultaneously intelligent, scalable, energy-efficient and secure is still an open problem. Key challenges include intelligence vs determinism, where AI-driven networks bring adaptability but reduce predictability. Balancing autonomy with reliability guarantees remains unresolved.

Another challenge is edge-cloud orchestration. Distributing computation dynamically across edge and cloud while ensuring consistency, low latency and fault tolerance is still complex. Energy efficiency at scale is also a major concern, as billions of IoT devices demand ultra-low-power communication, efficient protocols, and sustainable infrastructure.

Security at scale (Zero Trust for IoT) presents another significant challenge. Traditional security models do not scale to billions of endpoints. We need embedded, hardware-level, and identity-driven security models. Interoperability is equally important, as heterogeneous ecosystems involving devices, vendors, and protocols create fragmentation, which remains a major engineering bottleneck.

From an engineering perspective, these are some of the biggest unsolved challenges in designing networks that will cater to billions of interconnected devices in the next decade.



In a previous discussion, you highlighted the growing disconnect between industry expectations and academic preparation in information security. Since then, have you observed any meaningful progress in bridging this gap, or are engineering institutions still teaching cybersecurity as a subject rather than embedding it as a design philosophy across disciplines?

There has been some progress—but not enough. Many institutions have introduced cybersecurity courses or programs, which is positive. However, security is still often treated as a specialization, not a foundational design principle. Students learn about attacks and tools, but not secure system design. In industry, security is a lifecycle concern, integrated across architecture, coding, deployment, and operations.

In academia, it is still largely a standalone subject. The shift required is from "Learn cybersecurity" to "Engineer secure systems by design". This means embedding security into networking courses, OS and distributed systems, IoT and embedded systems and AI/ML pipelines.

Much of India's engineering innovation narrative revolves around software and AI startups. However, communication technologies, network infrastructure, and industrial automation remain strategic sectors. What kind of engineering research and product development should India prioritize today if it wants to become a technology creator rather than merely a technology consumer?

India must move beyond application-layer innovation and invest in deep engineering capabilities. Key priorities must include communication

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infrastructure technologies such as 5G/6G systems, software-defined networks, and satellite communication systems.

The country must also focus on semiconductor and embedded systems, particularly indigenous chip design and edge compute platforms. In addition, industrial automation and Industry 4.0 initiatives involving cyber-physical systems and smart manufacturing platforms should be a major area of investment.

Cybersecurity for critical infrastructure is another important priority, including OT security and national-scale cyber resilience. Equally important is platform-level innovation. Instead of building apps on external platforms, India should be building platforms, protocols, and frameworks.

In summary, the strategic shift must come from "using global technology" to "defining global standards and systems".

Having led projects involving industrial automation, smart cities, and consumer wearables, you've witnessed the evolution of IoT from concept to deployment. What is one major lesson from real-world implementations that engineering students rarely learn in classrooms but absolutely must understand before entering the workforce?

Being a practitioner, the biggest lesson I have learned is that real-world systems fail—not because of algorithms, but because of integration complexity. In classrooms, problems are clean and modular. In reality, devices fail, networks are unreliable, data is noisy or missing, systems are heterogeneous and maintenance is continuous. Success in building real-world systems requires focus on system robustness, graceful degradation and operational simplicity. Students must understand that engineering is less about building the system—and more about making it work reliably over time in imperfect conditions.

As someone who has spent nearly equal time in industry leadership and academia, how would you redesign a four-year engineering program if your goal was to prepare graduates for technologies that do not yet exist? What would you remove from the curriculum, and what would you introduce?

If the goal is to prepare for unknown technologies, the curriculum must shift from content-heavy to capability-driven. As such, I would like to reduce or remove excessive focus on tool-specific or language-specific training. I would also like to reduce redundant theoretical duplication across courses, and late introduction of systems concepts. On the other hand, I would like to introduce:

Stronger foundations earlier and deeper. This includes Systems thinking, Distributed systems, Networking fundamentals and Embedded systems basics

"Systems integration" should remain as the spine across all years. Every year should include projects that integrate hardware, software, networking and data

Security + reliability by design should be embedded across all courses—it cannot be optional.

Engineering under constraints must be focused on. Courses should introduce concepts and design principles to work under latency, energy, cost and scale constraints.

Industry-scale problem solving needs to be brought in. Capstone projects need to be introduced, based on real systems. This should include failure analysis & debugging and exposure to production environments.

Most importantly, we need to introduce the concept of "Learning how to learn". Since technologies will change, graduates must be trained in abstraction, first-principles thinking and continuous self-learning

If I had to summarize, the challenge today is not lack of knowledge—but fragmentation of understanding. We need to move from teaching technologies in silos to teaching how to engineer integrated, intelligent, and resilient systems. That is what will differentiate a graduate in the coming decade.

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ENGINEERING RESEARCH SHOULD FOCUS ON ACTUAL PROBLEM SOLVING

Prof. Saraju P Mohanty
Dean - AI, SRM University-AP

As engineering education undergoes a major transformation in the age of artificial intelligence, questions around cybersecurity, smart systems, rural innovation, and industry-ready research have become more relevant than ever. In this conversation, **Prof. Saraju P. Mohanty,** Dean - AI, SRM University, Andhra Pradesh shares his perspective with Education Post's **Prabhav Anand** on the future of engineering and technology, highlighting the need for stronger cybersecurity, AI-driven smart systems, and research that focuses on solving real-world problems rather than merely increasing publication numbers. He discusses the growing role of AI in agriculture, the importance of building secure IoT ecosystems, and the distinction between using AI tools and truly understanding AI engineering. He also outlines how institutions can prepare students for an AI-driven future while fostering innovation that addresses India's unique challenges.

You have often spoken about the importance of AI and smart systems working at the "edge" instead of depending fully on the cloud. Do you think Indian engineering colleges are still focusing too much on software and not enough on areas like embedded AI, chips, and smart hardware systems?

Both Edge computing and Cloud computing need an appropriate combination of hardware and software to be operational. Edge computing needs light duty hardware whereas cloud computing need heavy duty hardware. Correspondingly the software running on them have different features and capabilities. I think educational Institutes of India are covering both software aspects as well as hardware aspects. Of course, there is a notion that focus on software is more may be job market dictates these aspects.

Your research focuses a lot on making smart systems energy-efficient, secure, and intelligent. In today's technology world, where do you think India is still lacking the most — energy efficiency, cyber security, or smart system design?

In all these technologies India is in a progressive way. Hopefully, in current few years India will be in advanced stage. This can be possible if more research can be occurred in all these sectors with the supports of Industry and academia. In my view energy efficiency aspects lots of progress has been made we are using electric vehicle, solar power, etc. along with low-power hardware. Cyber security aspects can further improve. Smart systems with integrated AI, development of own LLM in India are still long way to go.

In your previous talks, you highlighted the need for stronger security at the device level in IoT systems. As smart devices become part of healthcare, agriculture, and cities, do you think cyber attacks in the future could start affecting real-world public safety as well?

Yes, cyber attacks could significantly affect real-world public safety. Let me provide couple of examples. Let us smart grid. If smart grid is hacked then a complete city can be made black out. Let us think about an autonomous vehicle. If it is hacked to manipulate a control signal from "putting a brake" to "slow down" then imagine the consequence. In a smart healthcare if insulin delivery dosage can be changed, imagine the impact on public safety! To overcome these issues, I have promoted a principle called "Security-by-Design (SbD)" to ensure that security is a design axis of any device or system to consider these threats from an early stage, rather than a afterthought.

You have worked on smart villages and technology for agriculture. Today, India is aiming to become a global AI and semiconductor hub. How can engineering research help solve rural problems and improve agriculture instead of staying limited to urban industries?

Agriculture is the driver of civilization. We need to do whatever needed to improve agriculture productivity when it is a fact that we loose farmable or cultivatable land due to various reasons including soil erosion, and rapid urbanization. We can integrate various smart agriculture devices, AI tools to enhance agriculture productivity and efficiency. For example, use of automatic irrigation involving right kind of sensors and AI can ensure optimal usage of water. AI with drone can be used to monitor crop damages due go natural calamities. AI with camera can be used for automatic monitoring of crop growth.

Having worked in both the US and Indian education systems for many years, what is the biggest difference you see in the way engineering research is done? What changes do Indian institutions still need to make to create globally strong research culture?

In my view engineering research should focus on actual problem solving rather than emphasizing for publications. No doubt publications are important for students. But actual prototypes and products can be transformative to advance society. Institutes can give more emphasis to patents, give emphasis to doing hands on, and solving problems relevant to India.

Today, many students are running behind AI because it has become a trend. In your opinion, what is the difference between simply learning AI tools and actually becoming a strong engineer in the AI era?

In my opinion, learning AI tools makes someone an AI application person. May be at best a big data analyzer. AI development overall is not about data analysis only. AI engineering involves lots of backend hardware and software developments as well as modeling. For example, AI needs heavy-duty hardware that some engineer is designing. AI LLM development is a huge effort that AI engineers and scientists are handling.

Based on your experience in AI, cybersecurity, IoT, and smart electronic systems, which engineering field do you believe will become most important in the next 10 years but is still not getting enough attention in Indian universities?

AI just started getting attention and is all set to grow in next 10 years. For example, at SRM-AP, as the founding Dean, I am building AI Technology Institute (AiTI) to make SRM-AP India's first AI-Native University that offers core AI programs, certifies each graduating student's AI-working competency, integrates AI in all programs, and incorporates AI in all aspects of academia.

THE ECONOMY OF AI REDEFINING VALUE AND MONEY

Monica Malhotra Kandhari
MD of AASOKA by MBD Group



Artificial intelligence is no longer a futuristic concept. It has emerged as a powerful economic force, reshaping industries, redefining productivity, and transforming how value is created.

The scale of this transformation is difficult to ignore. PwC estimates that AI could contribute up to $15.7 trillion to the global GDP by 2030, while McKinsey suggests that generative AI alone could create between $2.6 trillion and $4.4 trillion in profits annually through enhanced productivity and innovation. These figures underscore a fundamental reality: AI is no longer merely a technological advancement; it is rapidly becoming a cornerstone of future economic growth.

For decades, economic value has been closely associated with labour, capital, and scale. Businesses grew by expanding their workforce, building infrastructure, and investing heavily in production and distribution. Today, artificial intelligence is challenging these traditional assumptions. We are witnessing the emergence of a new economic paradigm, where the ability to generate insights, automate decision-making, and scale intelligence is becoming as important as physical assets and financial capital in driving growth and competitiveness.

More importantly, the AI era is redefining not only how economic value is created but also what constitutes value itself. Today, more and more wealth is being generated through intellectual property, algorithms, databases, and information.

The Age of Hyper-Efficiency

One of the most noticeable benefits of AI is the extreme efficiency that it provides to any enterprise. Activities that would previously have demanded entire teams of experts could now be done with just a few experts backed by AI tools. Whether it is developing software, analyzing data, content creation, customer support, marketing, or even strategy formation, it can now be supplemented by AI technologies that deliver outputs within a matter of minutes instead of days.

For MSMEs, AI is helping level the playing field. Businesses that once lacked the resources to invest in large teams or sophisticated systems can now access advanced capabilities through AI-powered tools. From customer engagement and market analysis to inventory management and content creation, AI is enabling smaller enterprises to operate with greater efficiency and agility, opening new opportunities for growth and innovation.

Data: The New Economic Asset

The AI-driven economy relies on high-quality data as its primary fuel. The better the information used in an AI application, the greater the chance it will be effective. As such, many organizations are starting to use their data management strengths to get ahead of the competition.

Unlike traditional assets, data becomes more valuable when it is analysed and transformed into actionable insights. Organizations are therefore investing heavily in data infrastructure, management systems, and analytics capabilities because the ability to extract meaningful intelligence from data has become a key driver of business performance and competitive advantage.

This development affects capital flow and how investments are structured since global investments are increasingly favoring companies with AI native solutions and products. Venture capitalists and institutional investors are looking more and more into the data and AI landscape and are investing more in data-centric businesses and applications.

In many cases, investors are increasingly placing a premium on companies that can leverage data and AI to create scalable revenue streams, even if they own relatively few physical assets. This marks a shift from traditional valuation models that primarily emphasized infrastructure, machinery, or other tangible assets.

Company valuations are being adjusted accordingly, as they take into account not just revenues and tangible assets but also intellectual property and data assets, among others. Companies with good AI infrastructure have a higher valuation than others, showing that data has become a powerful asset in the AI economy.

The Emerging Divide in the Workforce

As much as AI is opening up many doors, it is also revolutionizing the job market in very significant ways. AI proficiency is rapidly emerging as a critical skill that will shape employability and career growth across industries.

There is no doubt that professionals who use AI as part of their work become more productive and effective decision-makers. This applies to Real Estate, Agriculture, Pharmaceuticals, Banking, Education, and multiple other sectors.

According to the World Economic Forum's Future of Jobs Report, technological advancements are expected to displace around 92 million jobs globally by 2030 while creating approximately 170 million new ones. The net gain is encouraging, but the transition will demand large-scale reskilling and adaptation.

This problem is thus not merely one of adoption but of technology adaptation as well. People who accept AI as a complementary technology will undoubtedly open doors to opportunities and improved efficiency. Failing to do so may leave people at a disadvantage in the technology-based world of today.

Education as the Foundation of Economic Resilience

With the changing dynamics of economies, education will become a defining factor in deciding how people will benefit from AI. Apart from skills and expertise in technology, attributes like adaptability, critical thinking, creativity, communication skills, ethics, and problem-solving will become even more important because of the automation of routine processes.

AI is changing the economics of education as well. Previously, personalized education involved a lot of manpower and infrastructural support. With the development of AI-based technologies, personalized education, assessment, multilingual content delivery, and immediate feedback have been made possible for a huge number of students simultaneously.

Educational institutions will have the chance to enhance learning results and optimize their resource use. Educators will be able to spend less time on administrative processes and more time supporting individual learner needs. Through this approach, AI contributes to making quality education scalable, more accessible, and less costly.

India's potential for developing AI technologies appears immense. Due to the young population, with about 65 percent of its citizens being under 35 years old, India has one of the richest sources of future talent globally. Together with the rapid development of digital government systems, increasing connectivity rates, and a dynamic entrepreneurship environment, India can become a leading AI innovation hub soon.

This opportunity is reflected in initiatives such as the IndiaAI Mission, which aims to strengthen AI infrastructure, support innovation, and build a future-ready workforce.

Balancing Innovation and Responsibility

While there is much hope for the future with the advent of AI, many significant issues arise along with it. Issues such as privacy concerns, algorithmic biases, disinformation, cybersecurity, and unemployment are major issues that need attention.

For a sustainable AI economy to emerge, not only is technological development critical, but trust-building is equally important. Collaboration between the government, private industry players, schools, and technology companies needs to occur in order to ensure responsible adoption of AI technologies.

Many nations like Singapore, the United Kingdom, and South Korea have put heavy investments into training their citizens in AI skills, as well as building the necessary digital infrastructure. India can learn some lessons from their experience while building its own solutions.

Looking Ahead

The economy of AI is not only about efficiency or automation. It is an entirely new approach to creating, measuring, investing, and distributing value. And in this new economy, the key to success will be your capacity to convert information into insight, knowledge into innovation, and technology into sustainable growth.

It is no longer a question of wondering whether AI can add value, but how to distribute this value between different enterprises and nations. Businesses that learn to integrate creativity and artificial intelligence are likely to attract more investments, generate wealth and innovations, and gain competitive advantages.

The next-generation economy will be neither dominated by those who shudder before technology nor those who believe blindly in its power, but rather by those who will know how to use the technological revolution to enhance their unique human strengths. And that is the true power of AI—to extend rather than replace human potential.



BUILDING ACADEMIC QUALITY IN THE ERA OF MACHINE-GENERATED KNOWLEDGE

Dr. Prashant R. Nair,
Associate Director, Internal Quality Assurance Cell (IQAC)
Amrita Vishwa Vidyapeetham, Coimbatore

'The digital revolution holds immeasurable potential but, just as warnings have been voiced for how it should be regulated in society, similar attention must be paid to the way it is used in education. Its use must be for enhanced learning experiences and for the well-being of students and teachers, not to their detriment."

Audrey Azoulay, UNESCO Director-General

"AI must not usurp human intelligence. Rather, it invites us to reconsider our established understandings of knowledge and human learning"

Stefania Giannini, UNESCO Assistant Director-General for Education

The Gen_AI Effect

2023 will perhaps go down as the year of ChatGPT. In addition to being the fastest growing app in history, Generative AI (Gen_AI) models led by ChatGPT and including Microsoft Co-pilot, Google Palm & Bard, Amazon Hugging-face, Ernie, Llama and the like, using Large Language Models (LLM) pervaded all aspects of our lives. Any type of multimodal and multimedia can be mined for creating new knowledge as also summarization, Q&A, classification or out-of-the-box tasks. Disruptions have happened in every industry so as to speak because of this Gen_AI wave, be it education, transport, logistics, health and government. In terms of Gen_AI adoption, the potential benefits could include:

Provide instant access to vast amounts of information quickly

Aid diverse learners with different learning abilities, linguistic backgrounds or accessibility needs

Accelerate exploration and creativity, spark curiosity, suggest new ideas and ways of thinking towards scientific discovery

Gen_AI has disrupted the entire landscape of knowledge conception, dissemination, and evaluation. Universities are entering an era where information is abundant, machine-generated knowledge is ubiquitous and traditional indicators of academic achievement are being challenged. Universities need to adapt to the transition from a scenario of information scarcity to information explosion with 'big data' ruling the roost. They need to revisit why, what and how we learn. AI systems have emerged which can effectively mine this big data repository so as to generate essays, summarize research, write code, create multimedia content, and even assist in scientific discovery within seconds. AI fluency is now a mainstream skill needed by students irrespective of discipline.

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In terms of applications, the following are some Gen_AI use-cases for education:

- Generate content such as assignments, quiz, case study, problems, or writing scenarios for complimenting the teaching-learning process
- Use as virtual teaching assistant and help answering student questions, provides clarification, or offers guidance
- Assist in scientific discovery and research tasks including analysing large datasets, identifying patterns, and generating insights and research directions
- Write course plans, lesson plans, learning objectives, syllabi statements, and/or course policies
- Enable students to research topics & areas, iterate on text to improve written work, program, design, create code, art, music, & much more.

There is no doubt a flip side, with academic dishonesty and deterioration in quality on the rise due to this trend. Gen_AI also raises multiple immediate concerns related to issues such as safety, data privacy, copyright, and manipulation. The challenge is no longer obtaining information but evaluating its accuracy, relevance, originality, and ethical use.

There is a need to redefine new horizons for education in terms of human-centered digital learning and transformation. While ChatGPT reached 100 million active monthly users in January 2023, only one country released regulations on usage of Gen_AI as of July 2023. Today governments are clamoring towards regulation of AI. Iterative versions are outpacing the adaptation of national regulatory frameworks. There is a need for Ethical AI, Responsible AI, Sustainable AI and in the larger context….AI for Good.

Various challenges to academic quality in the context of Gen_AI may be summarized as follows:

- **Authenticity and Academic Integrity:** Machine-generated knowledge blurs traditional notions of authorship and originality. There is a lot of content without consent. Distinguishing between human-generated and AI-generated work has become increasingly difficult, raising concerns about academic honesty and the validity of assessments.
- **Erosion of Critical Thinking:** Over-reliance on AI tools may reduce students' engagement in independent analysis, problem-solving, and critical thinking. When AI provides immediate answers, the learning process itself may be sidestepped and bypassed.
- **Information Reliability:** Gen_AI systems can produce convincing but inaccurate or biased or fabricated information, which are now popularly referred to as hallucinations.
- **Assessment Validity:** Traditional assignments such as essays, reports, and coding exercises may no longer accurately measure student competence when AI can perform similar tasks with a higher level of efficiency.
- **Research Quality and Scholarly Communication:** AI can accelerate research production, potentially increasing publication volume while making it more difficult to evaluate originality and significance. Peer-review systems and research evaluation frameworks face increasing pressure to distinguish meaningful contributions from machine-generated outputs.

AI Usage Policy & Quality Assurance Frameworks

AI usage policies need to be based on a human-centered approach, which advocates that the use of AI should be at the service of the development of human capacities and capabilities for inclusive, just and sustainable futures. There is a need towards defining and promoting clear AI usage polices and quality assurance frameworks that focus on the following steps:

- Accreditation and ranking frameworks with metrics on institutional AI governance, digital ethics, and AI-enabled learning practices
- AI ethics and governance frameworks
- Outcome-based education (OBE) focused on developing skills, competencies and capacities amongst students rather than content creation and reproduction
- AI literacy in addition to AI fluency as a necessary skill for students and faculty.
- Transparent disclosure of AI use in all exercises and initiatives
- Awareness on Intellectual Property Rights (IPR) and laws of the land with respect to its infringement
- Authentic assessments such as viva voce examinations, problem-based learning, project-based learning, portfolios, and experiential learning focused on measuring learning outcomes
- Verification, source evaluation, and evidence-based reasoning
- Continuous monitoring of academic integrity

Academic quality in the era of machine-generated knowledge is increasingly measured by the capacity to think critically, create meaning, exercise ethical judgment, and apply knowledge responsibly in collaboration with intelligent machines. The universities that thrive will be those that shift their focus from knowledge transmission to human capability development, ensuring that graduates remain not merely consumers of AI-generated knowledge, but thoughtful creators and architects of knowledge itself.

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THE GREAT SQUEEZE

HOW AI IS REWRITING THE ENGINEERING CAREER PATH

Siddharth Verma

The prevailing debate surrounding artificial intelligence in the engineering labor market is often framed as a simple binary: Is AI a job-destroying force of automation, or a job-creating engine of productivity? This high-level view, however, misses a far more complex structural reorganization. The World Economic Forum projects that while 92 million traditional roles will be displaced globally by 2030, approximately 170 million new positions will emerge—resulting in a net positive gain of 78 million jobs.

But this massive macroeconomic transition will not be smooth or painless. What the engineering sector is actually experiencing is a phenomenon called "The Great Squeeze." AI is simultaneously hollowing out the entry-level career pipeline, creating a severe bottleneck for junior professionals, while supercharging demand and compensation for a highly specialized class of elite senior engineers. To understand the future of engineering, we must look past the binary hype and examine the friction of task-level automation, the cognitive decay of passive code generation, and the physical limits of automated systems.

The Hollowing of the Career Ladder

While overall tech sector employment continues to grow at a modest 2% annual rate , the entry point of the technical labor market has experienced a sudden, severe contraction. According to an analysis of ADP payroll data by the Stanford Digital Economy Lab, U.S. entry-level tech job postings plummeted by an astonishing 67% between 2023 and 2024. This collapse is mirrored globally, with the UK reporting a 46% decline and major European economies experiencing a 35% drop in junior technical positions. Consequently, the unemployment rate for recent computer science and computer engineering graduates has climbed to 7.0% and 7.8% respectively—matching or exceeding the unemployment rates of liberal arts majors.

This has created the "experience paradox," where entry-level positions routinely demand three to five years of experience, forcing junior engineers to operate as senior-level professionals just to secure an entry-level role.

While corporate executives frequently point to AI to explain these shifts—claiming that "Senior + AI = junior work automated"—the underlying driver is economic rather than technological.

During the Zero Interest Rate Policy (ZIRP) era of 2021, cheap capital incentivized speculative hiring and long-term talent cultivation; companies could easily afford to pay junior engineers to learn on the job. In the high-interest rate environment of 2026, capital constraints require immediate Day-1 return on investment.

Training budgets have been aggressively cut, and AI has become a convenient corporate scapegoat to justify headcount freezes to board members. Industry veterans call this "eating the seed corn". By hollowing out entry-level roles, companies are optimizing short-term quarterly earnings at the expense of their long-term viability, creating a high probability of a critical structural talent shortage by 2030.

The Illusion of Speed and Cognitive Decay

The commercial adoption of generative AI tools has been incredibly rapid, with 84% of developers using or planning to use AI coding assistants as of 2026. Yet, rigorous empirical research reveals a stark divergence between user perception and measured performance.

In a randomized controlled trial conducted by Model Evaluation and Threat Research (METR), 16 experienced open-source developers were evaluated completing 246 real-world coding tasks on large, active repositories utilizing state-of-the-art AI assistants. While the developers predicted that AI would speed them up by 24%, and self-reported feeling 20% faster, objective measurements revealed they were actually 19% slower overall.

This discrepancy is explained by the technical limits of off-the-shelf AI models, which lack awareness of internal patterns and specific codebase conventions. While the AI can generate syntactically correct code in seconds, it frequently misses the architectural intent, forcing developers to spend the time they "saved" on extensive reviews, refactoring, and debugging.

Furthermore, this "illusion of competence" carries a severe cognitive cost. An Anthropic randomized controlled trial evaluated 52 developers learning a new Python asynchronous library. The cohort using AI assistants scored 17% lower on subsequent comprehension and debugging quizzes than those who coded manually. The largest cognitive degradation occurred in debugging skills—the very capacity required to recognize when AI-generated code is incorrect and diagnose why it fails.

These findings align with John Sweller's Cognitive Load Theory. While technology that reduces extraneous load (such as syntax formatting) is highly beneficial, tools that completely offload the "germane load"—the beneficial mental effort required to build deep system comprehension—severely stunt long-term skill acquisition.

The long-term impact depends heavily on developer interaction patterns:

AI Delegation: Proposing prompts like "write a function that does X" yields the fastest task completion times but results in the worst retention and quiz scores below 40%.

Conceptual Inquiry: Utilizing the AI strictly as an interactive tutor—asking "how does this library work?" while coding independently—leads to the highest mastery, with comprehension scores consistently exceeding 65%.

Physical Boundaries and the Analog Sanctuary

The impact of AI is highly uneven across engineering domains. While software engineering is experiencing immediate and volatile task shifts, physical and physical-digital hybrid engineering disciplines are governed by strict physical and safety-critical limits.

In computer and electrical engineering, manual tasks are migrating to higher levels of abstraction. Tools like Quilter AI deliver physics-driven, bring-up-ready PCB designs within a single workday, achieving a 98% autonomous routing completion rate in 27 hours. In silicon chip design, Google DeepMind's AlphaChip utilizes reinforcement learning to generate optimized chip layouts in hours rather than the months of human effort it previously took.

However, this transition runs into strict physical limits, particularly in the domain of Analog and Mixed-Signal (AMS) design. Unlike digital design, which operates on clean abstractions of 0s and 1s, analog design operates on dynamic, continuous physical signals. AMS design lacks established standard cell libraries and rigid design rules, and is heavily dependent on creative, human-centric tradeoffs between noise, linearity, matching, and power consumption. Fully automating the true scope of AMS design with AI remains a highly complex hurdle, ensuring that analog domain experts remain irreplaceable.

Furthermore, in physical-world industries—such as aerospace, defense, and automotive—the adoption of AI is heavily constrained by legal liability and safety-critical standards. While an AI model can propose, rank, and forecast designs, it cannot sign off on a safety certification or take legal accountability for a structural failure. Under strict industry frameworks, human engineers must remain legally and operationally accountable for any decisions affecting safety, compliance, or significant cost.

The Golden Cage of AI Hyper-Specialization

As traditional boilerplate coding tasks are automated, the engineering job market has responded with an unprecedented surge in demand for specialized artificial intelligence and machine learning professionals. The current supply-to-demand ratio for qualified AI/ML engineers sits at an unbalanced 1:3.2, forcing companies to offer substantial compensation premiums to secure top talent.

As of 2026, the average AI/ML engineering base salary in the United States ranges from

$140,000 to $185,000, with total compensation regularly clearing $200,000 for mid-career engineers and exceeding $300,000 at the senior level when equity and bonuses are included. Specialized roles in hedge funds and quantitative trading firms regularly exceed $500,000 in base salary and can reach upwards of $1 million for principal positions.

This compensation structure is highly dependent on technical specialization. Machine learning engineers earn an average of 67% more than baseline software engineers, while specialized AI

engineers command a 97% premium over traditional developers. LLM and Generative AI specialists command the single largest salary premium in the field, with mid-level base salaries starting at $165,000 and senior base salaries reaching up to $350,000 or more.

Rebuilding the Ladder: A Strategic Path Forward

Treating AI tools merely as a mechanism to compress entry-level headcount is a short-sighted strategy that yields minimal immediate productivity gains while hollowing out the downstream talent pipeline. To successfully navigate this transition, organizations and engineering leaders must implement three critical shifts:

Redesign the Career Ladder: Rather than freezing entry-level hiring, firms must redesign junior developer roles to focus on "AI orchestration" and system verification, shifting early responsibilities from simple code execution to requirements validation, automated testing, and code review.

Establish Cognitive Guardrails: Teams must design guidelines that discourage complete code delegation. Developers should use AI assistants as interactive, conceptual tutors during the acquisition of unfamiliar skills to prevent the decay of critical debugging and evaluation capabilities.

Modernize the Interview Process: The classic whiteboard coding interview is highly ineffective in an era where AI can solve syntax-heavy puzzles in seconds. Companies must replace legacy methods with practical, prompt-based assessments to evaluate how candidates utilize AI to solve real-world system integration, architecture, and debugging problems.

AI is not going to replace human engineers, but engineers who know how to effectively collaborate with AI will inevitably replace those who do not. The true winners of the AI transition will be the organizations that realize productivity is not just about short-term speed, but about preserving the human cognitive capability to build, verify, and understand the systems of tomorrow.

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THE ANTI-CITIZEN PARTY DOCTRINE

WHEN DEMOCRACY MUST DISQUALIFY ORGANIZED POLITICAL CRIMINALITY

Ryan Baidya, Ph.D., MBA
Takshila Foundation, San Jose, California, USA

This article advocates for the Anti-Citizen Party Doctrine, a legal framework designed to disqualify political parties that systematically betray the public trust. The author argues that electoral participation is a privilege that should be revoked if an organization utilizes its power to facilitate corruption, violence, or institutional criminality. Using the Trinamool Congress (TMC) in West Bengal as a primary case study, the article details numerous allegations of extortion, physical abuse, and misuse of state resources by party-linked figures. The article suggests that when misconduct becomes structural rather than incidental, individual prosecution is insufficient to protect the democratic process. To preserve the integrity of the state, the author proposes a graduated system of penalties overseen by an independent judiciary to ensure parties remain accountable to the citizens they serve. Under this doctrine, any party proven to be structurally anti-citizen would face suspension or a complete ban from future elections.

The Case for an Anti-Citizen Party Doctrine

A democracy exists for citizens, not for political parties. Political parties are only vehicles through which citizens temporarily delegate public power. They are not owners of the state. They are not masters of the people. They are not entitled to administer forever. They are not above law, morality, or constitutional order.

Therefore, when a political party receives power from citizens but then uses that power to loot public resources, intimidate voters, protect criminals, suppress justice, permit rape and killing, and convert state machinery into a party-controlled network, that party should lose the privilege of participating in the electoral process.

This view is not anti-democratic. It is democracy defending itself.

The principle is simple:

A political party that becomes structurally anti-citizen should not be allowed to ask citizens for another mandate.

In Democracy, Parties Do Not Rule; They Administer

In a monarchy, rulers rule. In a dictatorship, rulers command. In a democracy, elected officials administer. They are not rulers; they are temporary public managers, trustees, and servants of the citizens. The treasury, police, courts, welfare systems, schools, hospitals, and administrative offices do not belong to the party in government. They belong to the citizens.

Therefore, when a political party receives the people's mandate, it receives not the right to rule, but the duty to administer honestly, protect citizens, preserve justice, and return power peacefully when the mandate ends.

Electoral Participation Is a Privilege, Not a License

In ordinary democratic debate, parties should be free to criticize, oppose, mobilize, campaign, and present alternative visions. No party should be banned merely because it is unpopular, ideological, regional, religious, nationalist, socialist, conservative, or sharply critical of the government.

But electoral participation cannot be treated as an unconditional right when a party itself becomes a machinery of citizen exploitation.

A party that contests elections promises public service. If it wins, it receives access to the treasury, police, administration, contracts, welfare systems, education, health institutions, and law-enforcement machinery. These are sacred public instruments. They belong to the people.

When a party uses those instruments for private enrichment, extortion, political revenge, and intimidation, it betrays the democratic contract.

One corrupt leader may be an individual criminal. A few corrupt members may suggest weak internal discipline. But when criminality appears across multiple levels—municipal officials, councillors, panchayat leaders, student-union spaces, local party figures, contractors, and protected cadres—then the question becomes larger. The question is no longer only whether individuals committed crimes. The question becomes whether the party organization itself became a shelter, beneficiary, and enabler of crime.

This was the concern expressed in my earlier note: when a large number of party members are caught in corruption or abuse, it is no longer enough to dismiss them as "bad apples"; the organization's principles and operating culture must be examined.

The TMC Example: Why This Question Has Become Urgent

The recent developments in West Bengal make this question unavoidable. Reports describe a series of arrests and seizures involving Trinamool Congress-linked figures after the change in political control. These include allegations of extortion, intimidation, corruption, relief material diversion, illegal cash storage, arms recovery, and sexual offences. Each case must be proven in court. But collectively, they raise a grave constitutional question. (See Appendix A)

Recent reports say police arrested several TMC-linked persons, including panchayat and municipal figures, amid allegations of post-poll violence, extortion, intimidation, corruption, firearm recovery, illegal storage of government relief material, welfare fraud, financial misconduct, and serious sexual offense allegations in one case. The report also mentioned cash recovery of about ₹3.4 crore connected to an arrested Baduria municipal figure and recovery of firearms and ammunition near his farmhouse.

In another report, police said about ₹2.24 crore in cash was dug up near the farmhouse of arrested TMC leader and Baduria Municipality chairman Dipankar Bhattacharya; this reportedly followed an earlier recovery of ₹80 lakh in cash and nearly 4,000 tarpaulin sheets allegedly meant for government relief distribution.

Kolkata also saw arrests of TMC councillors on extortion-related allegations. NDTV reported that Arijit Das Thakur and Sachin Singh, two Trinamool councillors from the Kolkata Municipal Corporation, were arrested on charges of extortion. Another recent report said TMC councillor Mahesh Sharma was arrested on extortion and intimidation allegations.

Reports also described the arrest of a TMC-affiliated man in connection with the discovery of cash and arms at Surendranath College. Another TMC councillor, Biswajit Mondal, was reportedly arrested in Kolkata amid assault and molestation allegations.

These are not final convictions. But they are not trivial allegations either. A democratic society must ask: if repeated reports involve cash, public relief materials, arms, extortion, intimidation, sexual misconduct, and party-linked figures, should the party be treated merely as a normal electoral competitor? Or should there be a constitutional inquiry into whether the party's ecosystem became anti-citizen?

Corruption Is Only One Part of the Problem

The issue is not only money. Corruption loots the public treasury, but rape, killing, torture, and intimidation attack the citizen's body, dignity, family, and right to live without fear.

West Bengal's record during the TMC administration has included serious allegations of political violence, post-poll retaliation, rape, murder, and institutional failure. In 2021, the Calcutta High Court ordered a CBI investigation into serious post-poll violence cases, including murder and rape allegations. CBI materials later reported post-poll violence investigations and, in 2025, the first conviction in a CBI-investigated West Bengal post-poll violence case involving the rape of a minor girl.

The RG Kar Medical College rape and murder case became another national symbol of citizen-safety failure. A woman trainee doctor was raped and murdered inside a Kolkata government medical institution on August 9, 2024; the Supreme Court Observer notes that the Supreme Court later took suo motu cognizance and that the Calcutta High Court had ordered a CBI probe. Reuters reported that the former RG Kar principal was charged with alleged evidence tampering, while a local police officer was arrested for alleged failure to protect the crime scene.

A political party should not automatically be banned because a crime occurred during its administration. Crimes happen under every government. But when repeated violence, rape allegations, intimidation, police failure, evidence tampering, and protection of accused persons appear under a party's political ecosystem, then the matter becomes larger than law and order. It becomes a question of democratic legitimacy.

When Does a Party Become Anti-Citizen?

A party becomes anti-citizen when it no longer treats citizens as sovereign people, but as prey, vote banks, subjects, or obstacles.

A party should be investigated as an anti-citizen organization when there is evidence that it has engaged in, tolerated, protected, or benefited from:

- systematic corruption;
- public-resource looting;
- extortion and "cut-money" networks;
- illegal occupation of property;
- diversion of welfare or relief materials;
- political violence;
- rape, molestation, killing, or torture;
- intimidation of voters and opposition workers;
- suppression of police complaints;
- protection of criminal leaders and cadres;
- misuse of police and administration;
- attacks on whistleblowers, journalists, victims, and witnesses;
- refusal to respect the peaceful transfer of power.

This does not mean every allegation is true. It means that when such allegations become widespread, repeated, and connected to party-linked actors, democracy must have a mechanism to investigate the party organization itself.

The Bad Apple Argument Is No Longer Enough

The "bad apple" argument has limits.

If one councillor is arrested, the party may say: individual misconduct.
If one local leader is caught with cash, the party may say: isolated corruption.
If one cadre commits violence, the party may say: personal crime.

But what if arrests occur across municipalities, panchayats, colleges, relief-distribution networks, property disputes, extortion cases, arms recoveries, and sexual-offence allegations?

Then the "bad apple" argument collapses.

At that stage, the proper question is:

Did the party merely contain some criminals, or did the party become a structure through which criminality gained political protection?

If a party's local leaders use fear to control citizens, if illegal money supports political operations, if police fail to act against party-linked criminals, if victims fear reporting crimes, and if leadership protects or rewards such persons, then democracy must look beyond individual prosecution.

It must examine the party.

Proposed Doctrine: The Anti-Citizen Party Doctrine

India needs a constitutional doctrine under which a political party can be suspended or banned from elections if it becomes structurally anti-citizen.

The doctrine may be stated as follows:

A political party shall be considered an anti-citizen political organization when, through its leadership, elected representatives, candidates, office-bearers, affiliated bodies, or organized cadres, it engages in, protects, tolerates, or benefits from systematic corruption, violence, rape, killing, extortion, intimidation, public-resource looting, obstruction of justice, or misuse of state machinery, and where such conduct is widespread, repeated, leadership-protected, and injurious to the life, dignity, property, liberty, voting freedom, or lawful rights of citizens.

Under this doctrine, a party like TMC—or any similar party, regardless of ideology—should not be allowed to participate in the electoral process if an independent constitutional inquiry proves that it functioned as an anti-citizen political organization.

The doctrine must apply equally to all parties. It must not be designed against one party alone. It must apply to TMC, BJP, Congress, CPI(M), regional parties, caste parties, religious parties, or any future party that behaves in the same manner.

The name of the party is secondary. The conduct is primary.

Why Individual Prosecution Is Not Enough

Some may argue that existing criminal law is sufficient. If a leader commits a crime, arrest him. If a councillor extorts money, prosecute him. If a cadre commits violence, punish him.

Yes, individual prosecution is necessary. But it is not enough when the party organization benefits from the wrongdoing.

A company may face corporate liability when its officers commit crimes for corporate benefit. A terrorist organization may be banned when its members act as part of a violent network. A nation may face sanctions when state policy violates human rights. Similarly, a political party must face organizational consequences when it becomes a political-criminal enterprise.

Otherwise, a party can enjoy the fruits of crime while sacrificing only a few expendable individuals.

That cannot be democracy.

The Penalty Should Be Graduated

A full ban should be the final step. But a serious democracy must have a penalty ladder.

First, there should be an independent inquiry.

Second, guilty individuals should be disqualified from contesting elections.

Third, illegal assets should be seized.

Fourth, party-linked financial networks should be audited.

Fifth, the party may lose public funding, tax benefits, and election-symbol privileges.

Sixth, if the party is structurally corrupted, it may be suspended for one or more election cycles.

Seventh, in the gravest case, the party should be banned from elections.

This is not revenge. It is constitutional hygiene.

A party that has used public power against citizens should not be allowed to return to the same citizens and ask for another mandate without first facing institutional accountability.

Safeguards Against Misuse

This doctrine must not be controlled by the ruling party. Otherwise, every ruling party will accuse its opponents of being anti-national or anti-citizen.

Therefore, any ban must require:

- independent investigation;
- public evidence;
- party's right to respond;
- protection for witnesses and victims;
- judicial hearing;
- written findings;
- right to appeal;
- periodic review;
- high standard of proof.

The decision should be made by a constitutional tribunal or the Supreme Court, not by political executive order.

This is important. Without safeguards, the doctrine becomes authoritarian. With safeguards, it becomes democratic self-defense.

A Draft Legal Standard

A possible constitutional or statutory provision may read:

Where a political party is found, after independent investigation and judicial determination, to have systematically engaged in, enabled, protected, or benefited from corruption, violence, extortion, rape, killing, intimidation, public-resource looting, obstruction of justice, or misuse of state machinery, and where such conduct is widespread, repeated, and linked to the party's leadership, elected representatives, office-bearers, candidates, affiliated bodies, or organized cadres, such party may be declared an Anti-Citizen Political Organization.

A second clause may provide:

Upon such declaration, the party may be subjected to graded penalties, including audit, seizure of illegal assets, disqualification of responsible leaders, withdrawal of recognition, freezing of election symbol, suspension from contesting elections, and, in the gravest cases, a complete ban from participating in the electoral process.

TMC and Similar Parties Should Face This Standard

Citizens' view is clear: TMC or any similar party should not be permitted to participate in the electoral process if it is proven that the party became a systematic anti-citizen organization.

This conclusion does not depend on political hatred. It depends on a democratic principle: the citizen is higher than the party.

A party that misuses the people's mandate to harm the people cannot claim a permanent right to return to the ballot.

Electoral democracy cannot mean that citizens are forced to choose again and again among organizations that have already shown contempt for citizen safety, public money, women's dignity, justice, and free political participation.

Conclusion:
The Citizen Comes Before the Party

Democracy must protect political competition. But first, democracy must protect citizens.

The right of citizens to live without fear is greater than the right of a party to contest elections. The dignity of women is greater than a party symbol. The safety of voters is greater than the ambition of leaders. Public money belongs to the people, not to party networks. Police must protect citizens, not political criminals.

Therefore, a party that becomes anti-citizen forfeits its democratic legitimacy.

The final principle should be stated without hesitation:

A political party that uses democracy to capture power, and then uses power to loot, intimidate, rape, kill, suppress, and exploit citizens, should not be allowed to participate in democracy again unless it is investigated, cleansed, restructured, and proven fit to serve the people.

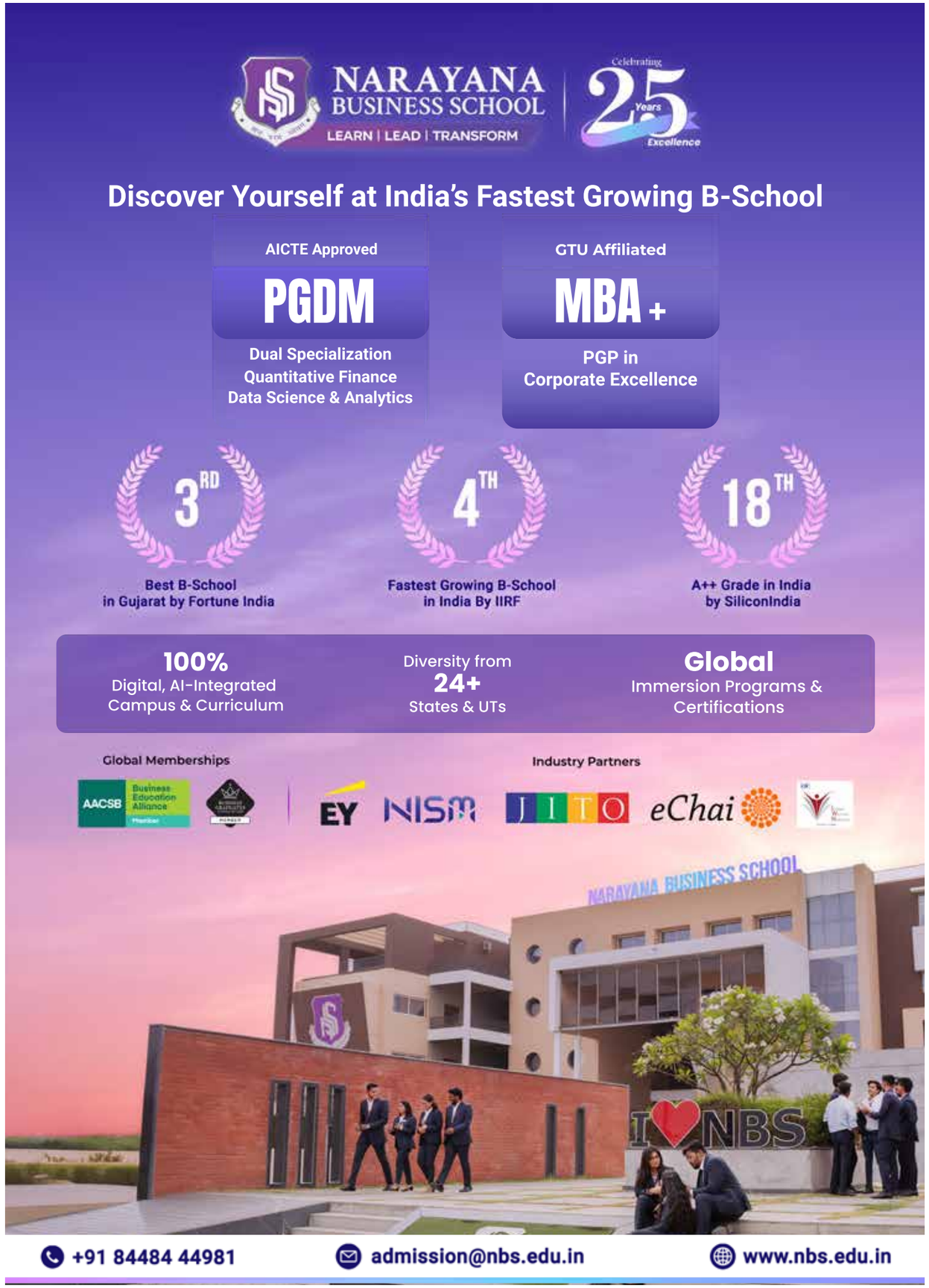
This doctrine is not anti-democratic.

It is the minimum self-defense of a democracy that still believes the citizen is sovereign.

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Appendix A

Some High profile Corruption Examples

The major, systemic corruption operations that resulted in formal First Information Reports (FIRs), chargesheets, or high-profile arrests of Trinamool Congress (TMC) party members and their close affiliates between 2011 and 2026 are:

1. The Large-Scale Ponzi Schemes (2 Scams)

- The Saradha Group Financial Scandal (2013): A multi-state Ponzi scheme totaling an estimated ₹2,500 crore to ₹25,000 crore. It targeted millions of low-income investors and led to the direct arrests of TMC MPs Kunal Ghosh and Srinjoy Bose, alongside state minister Madan Mitra.
- The Rose Valley Scam (2014): An even larger consortium fraud, estimated by the ED to have siphoned off over ₹15,000 crore. High-profile TMC lawmakers, including Sudip Bandyopadhyay and Tapas Paul, faced formal arrest and detention by central agencies.

2. Bribery and Illegal Trade Rackets (3 Scams)

- The Narada Sting Operation (2016): A direct institutional bribery scandal where a journalist filmed multiple high-ranking TMC cabinet ministers, MPs, and MLAs accepting cash on camera in exchange for corporate favors.
- The Cross-Border Cattle Smuggling Scam: A massive, federally investigated parallel economy operating along the India-Bangladesh border. It resulted in the arrest of influential TMC district president Anubrata Mondal.
- The Illegal Coal Mining Scam: An illicit operation involving the extraction and black-market sale of coal from Eastern Coalfields reserves, which directly entangled several top-tier party coordinators and family affiliates.

3. The Institutional Recruitment Scams (2 Scams)

- The School Service Commission (SSC) & TET Scam (2022): A sprawling "cash-for-jobs" scheme where thousands of qualified candidates were bypassed for teaching positions in exchange for bribes. It led to the recovery of over ₹50 crore in cash from properties linked to Education Minister Partha Chatterjee, leading to his arrest.
- The Municipalities Recruitment Scam (2023–2026): A mirror operation of the school scam, expanding across municipal civic bodies. Investigations into this structural bribery racket have been highly active, recently leading to the ED arrest of former minister Sujit Bose.

4. Welfare, Distribution, and Civic Scams (3 Scams)

- The Public Distribution System (PDS) Ration Scam: An investigation into the systemic diversion and black-marketing of subsidized food grains meant for poor welfare beneficiaries, resulting in the arrest of former Food Supplies Minister Jyotipriya Mallick.
- The Welfare Schemes Leakages (Housing & MGNREGA): Widespread federal probes into the diversion of central funds meant for the Pradhan Mantri Awas Yojana (housing) and fake job cards under the 100-day rural employment guarantee scheme.
- The Civic Infrastructure and Development Scams: Smaller, localized institutional financial misappropriations formally documented by investigative bodies, such as the Siliguri-Jalpaiguri Development Authority (SJDA) fund diversion and the Kolkata Municipal Corporation (KMC) street-lighting procurement inflation.
- Regarding diverted funds, central investigative agencies allege that hundreds of crores of diverted public money were laundered through a web of shell companies, real estate investments, and rural industries. In the teacher recruitment scam alone, the ED attached over Rs. 636 crores of laundered funds.
- The TMC has consistently denied these allegations, characterizing the investigations as political vendettas orchestrated by the central government using federal agencies.

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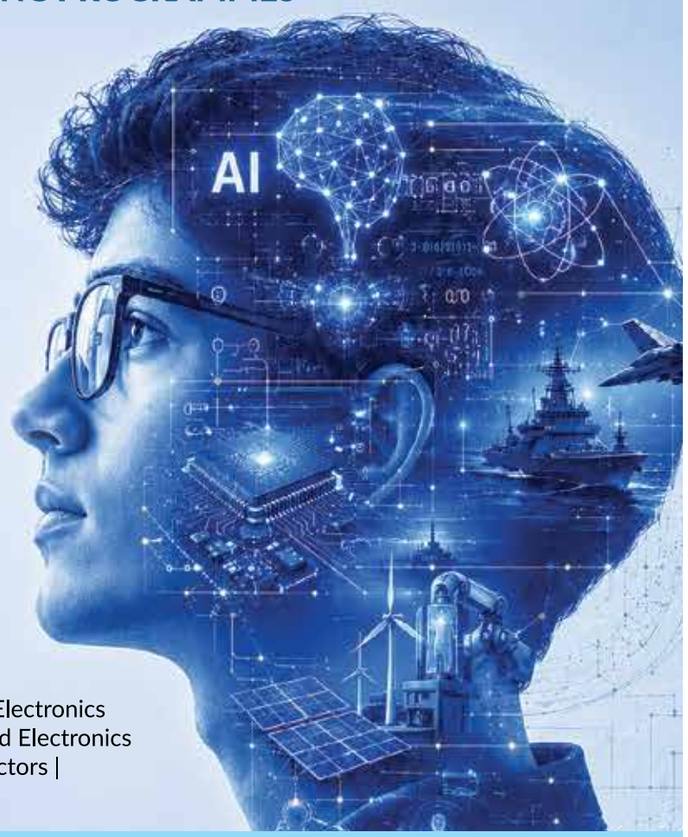
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FROM CLASSROOMS TO PROBLEM-SOLVERS

EXPERTS CALL FOR A TRANSFORMATION OF ENGINEERING EDUCATION

Future-ready engineers need more than technical knowledge, experts say, while stressing the importance of innovation, industry exposure and real-world problem-solving.

The engineer of the future cannot be prepared through textbooks alone.

That message emerges strongly from engineers, educators and students across Kashmir as they reflect on the changing role of engineering education in a world shaped by climate change, technological disruption and unprecedented infrastructure demands.

For decades, engineering education was largely associated with mastering equations, drafting designs and earning professional qualifications. However, today its purpose extends far beyond classrooms and examination halls. It is increasingly viewed as a force that shapes economies, communities and the physical infrastructure on which societies depend.

In a region like Kashmir, the stakes are even higher.

Nestled within a fragile Himalayan ecosystem, the region faces a unique combination of challenges, including seismic vulnerability, difficult terrain, climate-related risks, rapid urban growth and increasing infrastructure needs. The students sitting in engineering classrooms today will eventually design the bridges, tunnels, hospitals, power systems, drainage networks and urban spaces that define Kashmir's future.

Experts argue the challenge is no longer about producing more engineers but it is about producing better engineers.

Engineering begins where the classroom ends

"The biggest mistake we make is believing that textbooks alone can produce engineers," says Mudasir Mushtaq Wani, an extensively experienced structural engineer from north Kashmir.

"The future demands problem-solvers who can navigate real-world challenges, embrace emerging technologies and create solutions that are practical, sustainable and relevant to society. The classroom is where engineering begins, not where it ends." he told Education Post.

Wani believes engineering education must become more deeply connected to local realities. Alongside conventional subjects, students should be exposed to seismic design, mountain infrastructure, hydrology, climate resilience and sustainable urban development.

"We need engineers who can address the challenges of their own environment rather than simply replicate solutions developed elsewhere," he says.

According to him, the profession itself is undergoing a profound transformation. Artificial intelligence, digital modeling, automation, data analytics and smart infrastructure are rapidly changing how engineers work and solve problems.

"The future belongs to engineers who can combine technical knowledge with innovation," Wani says, stressing that institutions must continuously update curricula to prepare graduates not only for today's jobs but also for technologies that will define the coming decades.

Yet one of the most persistent weaknesses, he observes, remains the gap between academia and industry.

"Students often graduate with strong theoretical foundations but limited exposure to practical execution. Internships, field visits, industry collaborations and participation in live projects should become an integral part of engineering education rather than optional experiences."

For Wani, the ultimate purpose of engineering education is not simply employment.

"An engineering degree should not produce job seekers alone. It should produce creators, innovators and leaders who can identify problems, think critically and build solutions that improve society."

Preparing engineers for an uncertain future

The demands awaiting future engineers are unlike those faced by previous generations.

To a question, Wani said climate change, resource scarcity, rapid urbanization and technological disruption are creating challenges that cut across disciplines and require new ways of thinking.

"Preparing future engineers requires a multidisciplinary approach," he said. "Engineering must be taught alongside sustainability, environmental stewardship, communication skills and ethical responsibility."

While technical competence remains fundamental, he believes adaptability and lifelong learning will increasingly determine professional success.

That view is shared by Riyaz Ahmad, a final-year Civil Engineering student at SSM College of Engineering, Parihaspora.

"Technologies evolve, industry standards change and new challenges emerge," Ahmad says. "The most valuable skill an engineer can develop today is the ability to continuously learn and reinvent oneself."

He argues that meaningful investments in engineering education are essential if India hopes to build world-class infrastructure.

"Laboratories, research facilities, faculty development, industry partnerships and innovation ecosystems are not luxuries. They are investments in the future of our economy and society."

Building engineers for Kashmir's realities

For Bilal Farooq, senior engineer and owner of Buildra Architects and Engineers in Anantanag district, engineering education must move decisively away from rote learning and theoretical instruction.

"Engineering education must stop producing graduates who know formulas and start producing professionals who can solve real problems," he told Education Post.

Drawing from years of professional experience in Kashmir's complex infrastructure landscape, Farooq argues that students must be exposed early to live projects, field conditions, emerging technologies and multidisciplinary thinking.

"The challenges facing today's engineers are far more complex than what can be learned within the four walls of a classroom. Industry engagement, research, innovation and practical problem-solving should be at the heart of every engineering programme."

Farooq believes the region's educational institutions must align training with Kashmir's unique engineering realities.

"Kashmir presents distinct challenges, from seismic vulnerability and mountainous topography to climate-related risks and rapidly growing urban centres. Our institutions must prepare students to address these realities through a combination of technical excellence, critical thinking and hands-on experience."

The modern engineer, he says, must be equally comfortable on a construction site, in a research laboratory and in a technology-driven digital environment.

"That is the kind of professional the industry increasingly demands."

Engineering the cities of tomorrow

As towns and cities across Kashmir continue to expand, the pressure on infrastructure is intensifying.

Farooq identifies rapid urban growth as one of the most significant concerns facing the engineering profession today.

"Structural safety, drainage planning, traffic management, utility networks and environmental sustainability must evolve together," he said, adding engineering can no longer operate in isolation.

"It must work hand in hand with urban planning, architecture, environmental science and public policy. The future of Kashmir's cities will depend on how effectively these disciplines collaborate."

His assessment reflects a broader shift in contemporary engineering, where solving complex challenges increasingly requires cooperation across multiple fields rather than expertise confined to a single discipline.

The rise of a new generation

Amid these challenges, a new generation of engineers is beginning to shape Kashmir's future.

Graduates from engineering institutions across the region are entering fields ranging from structural design and renewable energy to environmental engineering, transportation planning and geotechnical research.

What distinguishes many of them, experts say, is a growing commitment to solving local problems through locally relevant solutions.

"Their work reflects an understanding that Kashmir requires context-specific engineering," says Farooq. "What succeeds in a metropolitan city may not succeed in a mountain valley. What works in a tropical climate may fail during a Kashmiri winter."

Wani sees this as a significant and encouraging shift in thinking.

"Young engineers are exploring innovative solutions ranging from earthquake-resistant housing models and solar-powered infrastructure to sustainable drainage systems and climate-adaptive urban planning," he says.

The emergence of this locally grounded approach may ultimately define the future of engineering in Kashmir.

As infrastructure ambitions grow and technology continues to reshape the profession, one message stands out clearly: engineering education can no longer be measured by how much theory students learn, but by how effectively they are prepared to solve the real problems of the world around them.

The future will belong not to engineers who simply know formulas, but to those who can transform knowledge into solutions.



INDIA CAN'T GET ENOUGH OF ENGINEERING

BUT CAN EVERY GRADUATE COUNT ON ITS PROMISE?

Fatima

Engineering enrolment has climbed to an eight-year high and employability is improving, yet career outcomes remain sharply uneven. As students continue to flock to BTech programmes, questions persist about what an engineering degree can realistically deliver in today's economy.

For generations of Indian families, engineering has been more than an academic discipline. It has been a symbol of aspiration.

Few degrees have shaped India's middle-class ambitions as profoundly. From the IT boom of the 1990s and early 2000s to the rise of global technology services firms, engineering emerged as a reliable route to stable employment, financial security and social mobility. Coaching centres expanded across cities and towns, engineering colleges mushroomed, and campus placements became the ultimate measure of success.

For many households, the formula seemed straightforward: secure a good rank, earn an engineering degree and step into a promising career.

Two decades later, that dream remains remarkably resilient.

According to data from the All India Council for Technical Education (AICTE), BTech enrolment touched an eight-year high of 12.53 lakh students in the 2024-25 academic year. Computer Science Engineering (CSE) alone accounted for nearly 3.9 lakh enrolments, making it by far the most sought-after branch. Vacancy rates have also declined significantly compared to previous years, indicating renewed student interest in engineering education.

The numbers challenge a popular assumption that students are moving away from engineering. If anything, demand appears to be strengthening again.

Yet there is another side to the story.

A recent analysis by Unstop Talent found that 39% of engineering graduates earn less than ₹7 lakh annually. While engineering continues to attract students in large numbers, career outcomes vary widely depending on the institution, branch, skills and opportunities available to graduates.

The contrast raises an important question: if engineering remains one of India's most popular degrees, why do outcomes appear so uneven?

The rise, fall and rebound of engineering

The current resurgence is particularly noteworthy because it follows a period of significant turbulence.

During the 2000s, India witnessed an unprecedented expansion in engineering education. Hundreds of private colleges were established to meet growing demand from students eager to enter the technology sector. At its peak, engineering was widely viewed as the safest pathway to a white-collar career.

However, the rapid expansion also created challenges.

As the number of colleges grew, concerns emerged about infrastructure, faculty quality and employability. Many institutions struggled to attract students, thousands of seats remained vacant and several colleges eventually shut down. For a time, the engineering sector appeared to be facing an identity crisis.

The latest enrolment figures suggest that engineering has regained momentum. But the comeback is not uniform across all disciplines.

Why computer science dominates

The most striking feature of engineering education today is the overwhelming popularity of computer science.

Students are increasingly choosing disciplines linked to software development, artificial intelligence, machine learning, cybersecurity and data science. Colleges have responded by expanding CSE seats and launching specialised programmes tailored to emerging technology sectors.

The trend mirrors broader changes in the economy.

India's technology industry continues to generate opportunities in software services, cloud computing, digital transformation and AI-driven applications. These sectors often offer higher salaries and faster career progression than many traditional engineering domains.

As a result, not all engineering degrees are viewed equally by students or employers.

A computer science graduate entering the workforce today is likely to encounter a different set of opportunities than someone graduating in a traditional discipline with slower hiring growth.

This divergence helps explain why engineering remains attractive overall while outcomes differ considerably across branches.

Employability is improving, but challenges remain

Recent employability data paints a mixed picture.

According to the India Skills Report 2026, employability among B.E. and B.Tech graduates reached 71.5% in 2025, the highest level recorded in five years. Computer science graduates recorded employability of around 80%, while information technology graduates also performed strongly.

These figures suggest that demand for technical talent remains robust.

Yet employability should not be confused with employment quality.

A graduate may be considered employable but still struggle to secure a high-paying role. Similarly, graduates from different institutions can experience vastly different outcomes despite holding the same degree title.

The challenge facing engineering education today is therefore not simply about creating jobs. It is about ensuring that graduates possess the skills required to compete in a rapidly evolving labour market.

The skills gap debate

For years, industry reports have highlighted concerns about job readiness among engineering graduates.

Employers frequently point to gaps in practical training, industry exposure, communication skills and problem-solving abilities. While students often acquire theoretical knowledge, many graduate with limited hands-on experience applying those concepts in real-world settings.

The issue is not unique to engineering, but it carries particular significance in a field closely tied to technological change.

Companies increasingly seek candidates who can adapt quickly, learn new tools and work across interdisciplinary environments. The ability to apply knowledge often matters as much as the knowledge itself.

This helps explain why some graduates command premium salaries while others struggle to secure comparable opportunities.

A changing definition of success

The engineering degree itself is also evolving.

For previous generations, engineering was often viewed as a destination. The objective was straightforward: earn the degree and secure a job.

Today's students operate in a more complex landscape.

An engineering graduate may pursue a traditional technical role, but they may also move into product management, entrepreneurship, consulting, higher education, public policy, finance or emerging technology sectors.

At the same time, advances in artificial intelligence and automation are reshaping workplace expectations. Employers increasingly value adaptability, analytical thinking and continuous learning alongside technical expertise.

This does not diminish the value of an engineering education. Instead, it broadens the range of possibilities associated with it.

What the numbers really tell us

Viewed individually, recent statistics can appear contradictory.

Enrolment is rising. Employability is improving. Yet concerns about salaries and career outcomes persist. Taken together, however, the data points to a more nuanced reality.

Engineering remains one of India's most sought-after degrees. Students continue to compete fiercely for seats, particularly in technology-focused disciplines. Industry continues to hire engineers, especially those equipped with relevant skills.

But the promise of engineering is no longer uniform.

The gap between the best outcomes and average outcomes has widened. Branch choice, institutional quality, practical skills and industry alignment increasingly determine career trajectories.

India's engineering sector, therefore, is not facing a crisis of popularity. It is facing a challenge of outcomes.

The question is no longer whether students want engineering. The answer appears to be yes.

The more pressing question is whether India's engineering ecosystem can ensure that the growing number of students entering engineering programmes are equipped to translate that degree into meaningful and sustainable career opportunities.

As enrolment continues to rise, the future of India's engineering dream may depend less on how many students enter the system and more on what awaits them when they leave it.

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WHY MILLIONS CHASE IITS WHILE ENGINEERING SEATS GO VACANT

Prabhav Anand

Every year around April and May, a familiar scene unfolds across India. Outside examination centres, anxious parents wait in the heat while students emerge from halls discussing cut-offs, tricky physics questions, and whether this year's mathematics section was tougher than the last. In cities such as Kota, Hyderabad, Delhi, Patna and Chennai, the engineering entrance season resembles a national event. Coaching institutes release advertisements celebrating top ranks, social media fills with success stories, and millions of students pin their hopes on a single examination.

To an outside observer, it would appear that India's love affair with engineering is stronger than ever.

And yet, hidden behind the frenzy surrounding the Joint Entrance Examination (JEE), another reality exists. Across several states, thousands of engineering seats remain vacant year after year. Counselling rounds are extended, admission deadlines are revised, and colleges struggle to attract students despite offering programmes that were once considered pathways to secure careers.

At first glance, the two realities seem impossible to reconcile. How can a country that produces some of the world's most competitive engineering aspirants simultaneously struggle to fill engineering classrooms?

The answer lies in understanding how India's engineering dream has changed.

For an entire generation of Indians, engineering was more than a profession. It was a promise. Through the 1990s and much of the 2000s, becoming an engineer symbolised upward mobility. Families saw engineering as a reliable route to stable employment and a better quality of life. It did not matter greatly whether the degree came from an IIT, a state college, or a private institution. The qualification itself carried value.

Today, that equation has changed dramatically.

Students are no longer simply aspiring to become engineers. They are aspiring to become graduates of a very small group of institutions. The focus has shifted from engineering education to engineering prestige. In many households, the dream is no longer "engineering"; it is IIT, NIT, BITS Pilani, or a handful of elite colleges. Increasingly, it is also tied to one specific branch: Computer Science.

The distinction may sound subtle, but it has transformed the entire higher education landscape.

Recent admission cycles have revealed the growing divide. While the country's premier engineering institutions continue to witness overwhelming demand, thousands of seats in many other colleges remain vacant. Maharashtra reportedly recorded over 60,000 vacant engineering seats after multiple rounds of admissions last year. Similar patterns have emerged in Madhya Pradesh, Telangana and several other states. Even after repeated counselling rounds, many institutions struggle to achieve full occupancy.

The issue is not that students have lost interest in technical education. Rather, they have become highly selective about where they study and what they study.

Walk into any engineering counselling session today and a clear trend emerges. Students are often willing to compromise on college rankings if it means securing a seat in Computer Science or Artificial Intelligence. Conversely, many are reluctant to accept traditional disciplines such as Civil Engineering, Mechanical Engineering, Metallurgy or Production Engineering, even in well-established institutions.

This shift reflects broader changes in the economy. The technology sector has become the defining success story of modern India. Software exports, start-up unicorns, remote work opportunities and global technology careers have reshaped student aspirations. For many young people, engineering is no longer the destination; it is simply a route to enter the digital economy.

That mindset has created an unusual paradox. While India continues to require civil engineers to build highways, bridges, metro systems and smart cities, and mechanical engineers to support manufacturing ambitions, student demand remains concentrated in a narrow set of disciplines. The country's developmental priorities and student preferences are increasingly moving in different directions.

The rise of coaching culture has amplified this phenomenon. Over the past two decades, India's coaching industry has grown into a multi-billion-rupee ecosystem. Entire cities have been transformed by the business of preparing students for competitive examinations. Yet somewhere along the way, the conversation shifted. Coaching centres may advertise engineering entrance preparation, but what they often sell is admission into a select group of institutions.

For students and parents, success is measured less by the acquisition of engineering knowledge and more by the name printed on the degree certificate.

This obsession with prestige is not unique to India, but its scale is remarkable. In many families, a seat in a top-ranked institution is viewed as a validation of years of sacrifice, financial investment and social expectations. The engineering degree has become intertwined with questions of status and identity.

Employers, however, are beginning to complicate this narrative.

Recruiters across sectors increasingly emphasise skills over labels. While elite institutions continue to enjoy advantages in visibility and recruitment opportunities, employers are also looking for practical knowledge, adaptability, problem-solving abilities and industry exposure. The gap between what students expect and what industries require has become one of the defining challenges of engineering education.

Many institutions outside the top tier have struggled to keep pace with these changing expectations. Outdated curricula, limited industry interaction and inconsistent placement records have damaged confidence among prospective students. In an era where placement statistics circulate instantly through social media and student forums, reputation can rise or fall rapidly.

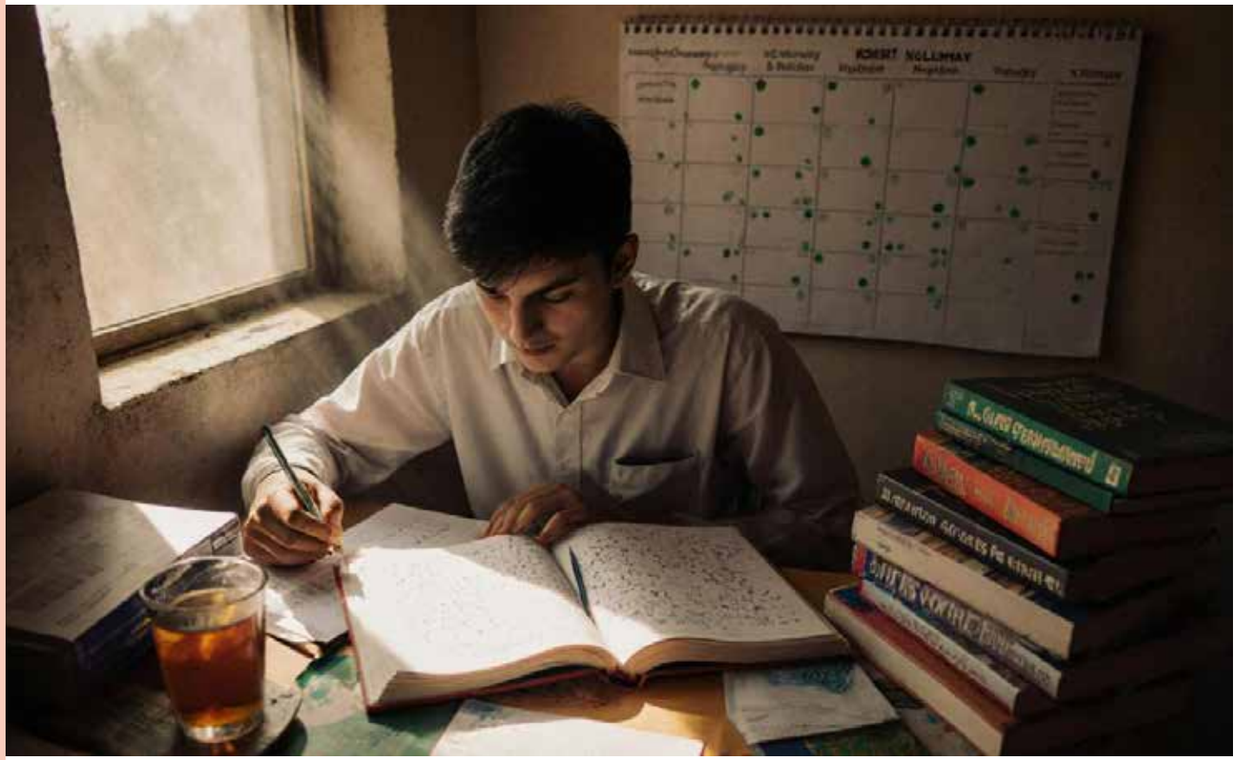
Students notice.

Parents notice.

And admission decisions reflect those perceptions.

Yet the story is not entirely one of decline. It is also a story of transition.

India today produces more engineering graduates



than almost any country in the world. The challenge is not the absence of engineering education but the uneven distribution of demand and opportunity. Some institutions are overwhelmed by applications, while others compete intensely for survival. Some branches struggle to attract students, while others remain oversubscribed.

In many ways, engineering education is experiencing the same market forces that have transformed other sectors of the economy. Students are acting more like consumers than ever before. They compare return on investment, placement outcomes, salaries, industry relevance and brand value before making decisions. The emotional appeal of engineering as a profession is increasingly being replaced by a practical assessment of career outcomes.

This represents a significant cultural shift.

For previous generations, becoming an engineer was often considered an achievement in itself. For today's students, the degree is only one component of a much larger career strategy. They are equally interested in entrepreneurship, finance, consulting, data science, product management and emerging technology roles. Engineering remains attractive, but not necessarily for traditional reasons.

Perhaps that is why the debate surrounding vacant engineering seats often misses the larger picture. The issue is not whether India still values engineering. The issue is what engineering means in contemporary India.

The engineering dream has not disappeared. It has become narrower, more competitive and more closely linked to prestige, employability and technological relevance. Millions of students continue to pursue it every year, but they are pursuing a different version of that dream than the one their parents chased.

As admission season unfolds once again, examination centres will remain crowded and coaching institutes will continue to celebrate top ranks. The headlines will focus on cut-offs, toppers and admission battles. Yet beyond those headlines, a quieter story deserves attention.

A country that once encouraged young people to become engineers is now asking them to become a very particular kind of engineer, from a very particular kind of institution, pursuing a very particular kind of career.

Whether that narrowing of ambition strengthens India's future or limits it may well become one of the most important education questions of the coming decade.

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HOW AI IS REWRITING THE ENGINEERING STUDENT JOURNEY IN INDIA

Artificial intelligence is transforming how engineering students learn, compete, build careers, and view their future, forcing India's technical education system to adapt faster than ever before, writes ***Pragya Kumari.***

"Science is about knowing; engineering is about doing."
-Henry Petroski (an American engineer)

The story of Indian engineering studies has always been a familiar one till date. It began from preparing for the entrance examination, entering the BTech program, sitting in theoretical classes, taking semester examinations, and getting placed at the end of their graduation years.

Engineering studies encouraged memorization, perfection, and bookish information. Being an engineer meant having high marks, mathematical skills, and job placement offers.

However, things have changed. Today's students do not rely only on lecturers or books. When there is a mistake in a coding language, it is fixed using ChatGPT before consulting any faculty member.

Artificial Intelligence has invaded engineering classrooms, hostels, internships, and preparations for placements throughout India.

Unlike previous advancements, AI is going to impact the very skills for which engineers spent years learning. This is precisely why engineering students view AI as both an opportunity and a threat.

When Curriculum Meets AI

India's entire engineering system is modeled on the needs of an industrial economy that values repetition and conformity.

Even now, several colleges are still holding onto inflexible syllabi, antiquated laboratories, and theory-based exams. Despite having more than 3,500 engineering colleges churning out over 1.5 million engineers every year, there is an acute problem of employability.

In fact, the 2024 Mercer-Mettl survey revealed that roughly 42.6% of the graduates were ready for technical positions. The recruiters have been citing poor practical knowledge, lack of communication skills, and lack of industry experience.

What AI has made abundantly clear is that the



traditional model of engineering education is archaic. Students attended lectures, copied notes, solved assignments, and referred to textbooks.

This process has now been shattered completely by AI technology. As per a TeamLease EdTech survey in 2025, about 74% of engineering students from urban India use AI-based platforms for their academic purposes. For many, AI has turned into a personal mentor available 24/7.

It becomes all the more critical in Tier-2 and Tier-3 colleges where shortages of qualified faculty members along with traditional pedagogies continue to prevail. They now have access to AI-driven knowledge and support, which was earlier reserved for prestigious institutes alone.

However, it throws up a serious challenge. If assignments can be solved in minutes using AI-based software, is learning happening here?

The Collapse of Memorization-Based Learning

Traditional engineering education used to favor those students who had mastered formulae and conventional derivation techniques. The equation has now changed because of AI.

With a chatbot capable of generating codes or writing lab experiments within minutes, memory holds little importance. The new generation understands that their future might not depend upon technical skills but creativity, analysis, and problem-solving capabilities.

This shift is already visible in the technology industry. AI-assisted coding tools are improving productivity and automating routine tasks handled by entry-level engineers.

According to a NASSCOM report of 2025, the AI industry in India was predicted to create at least two and a half million jobs by 2027 while also disrupting many other jobs.

To engineering students, this is both an opportunity and a challenge since artificial intelligence promises jobs and threatens many careers.

The Anxiety of Competing With Machines

Engineering students have experienced academic pressure all along, but the advent of AI has brought about another kind of fear. Earlier generations had concerns about their performance and prospects. The current generation worries about their survival.

Campus discussions increasingly revolve around questions like, Will coding jobs disappear? Will companies hire fewer freshers? Which engineering branches are future-proof?

The fear is strongest among students preparing for IT jobs because India's technology sector has long absorbed large numbers of engineering graduates into entry-level coding and support roles. Many of these repetitive tasks are now being automated.

Students are highly aware of this shift. Terms like "AI-proof careers" and "future-proof skills" dominate placement discussions and online forums. The pressure to remain employable has intensified.

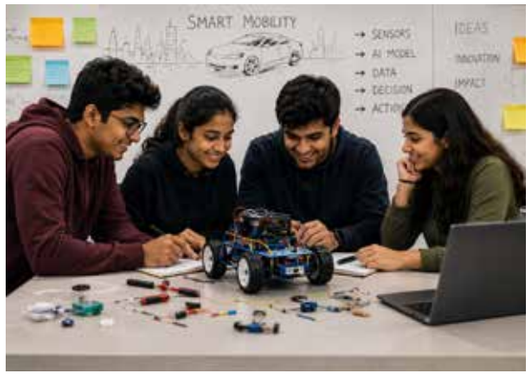
As a result, engineering students are beginning career preparation much earlier than before.

The Rise of the Constant Upskilling Culture

Traditional engineering education once revolved mainly around classroom academics. Today, students believe academics alone are not enough.

Modern engineering students are expected to manage coding practice, online certifications, internships, hackathons, AI workshops, LinkedIn networking, and personal projects alongside regular coursework.

In a survey conducted by Internshala in 2025, over 68% of engineering students reported spending additional hours every day learning skills beyond their college curriculum.



Coursera, NPTEL, Udemy, and YouTube platforms have become secondary learning systems. It is not uncommon for students today to depend more on creators on the Internet than lectures on campus.

This reflects a growing reality: students no longer trust colleges alone to prepare them for industry. While universities slowly revise syllabi, AI tools evolve every few months. Students know they must continuously learn to stay relevant.

However, this culture also creates exhaustion. Students constantly feel pressure to remain productive, visible, and employable. Coding contests, internships, certifications, and networking activities often continue alongside demanding academic schedules.

The modern engineering student is no longer just studying engineering. They are managing an employability strategy.

Engineering Branches Are Losing Their Boundaries

Artificial intelligence is also changing the structure of engineering disciplines.

Traditionally, branches operated separately. Mechanical engineers worked in manufacturing, civil engineers focused on infrastructure, and computer scientists dominated software. Today, those boundaries are weakening.

Mechanical students are learning robotics and automation. Civil engineers are using AI-based design tools and predictive modeling systems.

Electrical engineers are entering semiconductor and intelligent systems sectors. Even students from non-computer science branches are learning programming because digital skills are becoming essential everywhere.

This shift is influencing student preferences. AI, computer science, and data science branches continue to dominate admissions, while traditional branches often struggle to attract top-ranking students.

Career decisions are increasingly driven by salary potential, automation risk, and future demand rather than academic interest alone.

AI and the Academic Integrity Crisis

AI has also created a major challenge for engineering colleges: academic authenticity.

Professors increasingly struggle to identify whether assignments, coding exercises, and reports are written by students or generated through AI tools. Generative AI can now complete tasks within minutes that previously required hours of effort.

This exposes the weakness of traditional assessment systems that depend heavily on repetitive written work. If AI can easily complete an assignment, the educational value of that assignment itself becomes questionable.

Some institutions are responding with project-based learning, viva examinations, and application-oriented assessments.

But adaptation remains uneven. Many colleges still operate with outdated systems while students function in an AI-driven learning environment outside classrooms.

The Opportunity Side of the AI Revolution

Despite fears, AI also offers enormous opportunities for Indian engineering students.

India has one of the world's largest youth populations and technical education systems. AI tools can democratize learning by giving students from smaller towns access to high-quality educational resources.

A student with internet access can now learn machine learning, contribute to open-source projects, build applications, and even launch startups directly from college campuses. In many ways, AI is reducing the gap between elite institutions and smaller colleges.

India's startup ecosystem is strengthening this trend. AI-driven innovation is creating opportunities in healthcare, agriculture, logistics, finance, and education.

Engineering students are no longer limited to traditional placement routes. Many now aspire to become founders, freelancers, or remote developers. Hostel rooms are increasingly turning into startup workspaces.

Beyond Degrees

Artificial intelligence is not simply changing engineering education. It is changing the mindset of engineering students.

Earlier generations prepared for stable careers in predictable systems. Today's students are preparing for industries that evolve continuously. Adaptability has become more valuable than static expertise.

The engineering degree alone no longer guarantees security. Students who combine technical knowledge with creativity, communication skills, and problem-solving ability may succeed in this changing environment.

Across engineering campuses in India, one reality is becoming clear: the future will not belong to students who fear AI or depend blindly on it. It will belong to those who learn how to think, adapt, and innovate alongside it.



MONTHLY DIGEST

National Scholarship Portal Opens for 2026–27 Applications

The National Scholarship Portal has opened applications for the 2026–27 academic year, allowing eligible students to apply for merit-based and welfare-based scholarship schemes through a single digital platform.

Centre Accelerates Broadband Connectivity for Schools



The Ministry of Education has reiterated its commitment to expanding broadband access in schools, aiming to strengthen digital learning infrastructure and improve access to online educational resources.

Goa Introduces Holistic Progress Cards in Schools

Goa has begun piloting holistic digital progress cards that assess students beyond examination marks, focusing on skills, competencies, participation, and overall development in line with NEP 2020.

Prime Minister Research Chair Scheme Invites Global Indian Researchers

The Ministry of Education launched applications for the Prime Minister Research Chair Scheme 2026, aimed at attracting Indian-origin researchers working abroad to contribute to advanced research in India.

Telangana Announces Recruitment of DIET Lecturers



Telangana has announced recruitment for District Institutes of Education and Training (DIETs), strengthening teacher education institutions responsible for training future school educators.

India–France Educational Cooperation Expanded

New education initiatives announced during high-level India–France discussions will strengthen academic exchanges, student mobility, and institutional collaborations between universities of both countries.

NEET Re-Examination Security Measures Strengthened

Authorities have introduced stricter monitoring and administrative measures for the upcoming NEET re-examination to ensure transparency, fairness, and smooth conduct of the national entrance test.

Second-Chance Education Scheme Opens New Registrations

Madhya Pradesh has reopened registrations under its "Ruk Jana Nahi" programme, enabling students who could not clear board examinations to continue their education without losing an academic year.

Growing Focus on Research–Industry Collaboration

Education policymakers and institutions are increasingly encouraging partnerships between academia and industry to promote innovation, applied research, and skill development among students.

MONTHLY DIGEST

Bharat Innovates 2026 Highlights Research and Innovation



India and France jointly launched Bharat Innovates 2026 to promote collaboration in research, deep technology, innovation, and startup development, creating new opportunities for students and young researchers.

Scholarship Awareness Campaigns Intensify Across States

Several states have begun awareness drives to increase student participation in scholarship programmes and ensure that eligible learners benefit from available financial assistance opportunities.

Schools Prepare for Expanded Technology-Based Learning

With the new academic session underway, schools are investing in digital tools, smart classrooms, and online learning platforms to improve classroom engagement and learning outcomes.

Teacher Training Remains a Major Policy Focus

States are strengthening teacher training institutions and recruitment processes to improve classroom quality and support implementation of National Education Policy reforms.

International Research Opportunities Gain Momentum

New international collaborations and mobility programmes are creating greater opportunities for Indian students and researchers to participate in global academic and research initiatives.

Schools Shift Towards Competency-Based Assessment

Education authorities continue to promote competency-based evaluation systems that measure understanding, application, creativity, and problem-solving skills rather than rote learning alone.

Scholarship Schemes Target Greater Inclusivity

New and ongoing scholarship programmes are focusing on widening access for economically disadvantaged and underrepresented student groups to reduce educational inequalities.

STEM Learning Initiatives Continue to Expand

Schools and institutions are increasing investments in science, technology, engineering, and mathematics programmes to foster innovation and encourage research-oriented thinking among students.

Academic Mobility Becomes a Key Education Priority

Government initiatives are increasingly focused on supporting student mobility, international exchanges, and collaborative learning opportunities to strengthen global exposure for Indian learners.

Research Funding Discussions Gain Importance

Recent policy discussions have highlighted the need for stronger research ecosystems, greater funding support, and enhanced institutional collaboration to improve India's global research footprint.

New Academic Session Brings Focus on Foundational Learning

As schools across the country begin the new academic year, education departments are prioritising foundational literacy, numeracy, digital skills, and student well-being as key learning objectives.

MATHEMATICS CHALLENGE

CMT – SERIES PROBLEMS – by GANIT MATH (गणित मठ)

CMT-2020/74:

For $m < 0 < n$, if

$$a^2 - b^2 = 40, \quad ab = 99,$$
$$c^2 - d^2 = -95, \quad cd = 84,$$
$$\frac{m+1}{m-1} = \frac{a}{b}, \quad \text{and} \quad \frac{n+1}{n-1} = \frac{c}{d},$$

then

$$171n - 560m = ?$$

CMT-2020/75:

For non-zero and unequal integral $\tan\alpha$ and $\tan\beta$, if

$$(\tan\alpha - \tan\beta)^{\tan\beta - \tan\alpha} = 1,$$

then, how many integral value(s) is/are possible for $2\tan(\alpha - \beta) + 1$?

Test your IQ:

Solve for positive integral value(s) of x and y without hit-and-trial:

$$(x-3)y^2 - y + x^3 - 3x^2 + 3x = 0,$$
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Answers:

CMT-2020/73: $(i)\ \frac{72}{5} \quad (ii) -\frac{72}{5}$

Answers will be published in the next issue. You can ask any queries and send your solution to: Email: ganitmath.india@gmail.com, M: +91 8826337312.
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