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From code to core

Why Basic Sciences still matter in Engineering education

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In many engineering colleges across India, a discernible curricular shift is underway; one that reflects not just pedagogical reform but also a deeper reordering of priorities. Courses such as Engineering Physics and Engineering Chemistry – long regarded as the intellectual bedrock of Engineering education – are being reduced, merged, or, in some instances, removed from the first-year curriculum.

This is driven largely by the growing dominance of programmes such as Computer Science Engineering, Information Technology, Artificial Intelligence, and Data Science, which are widely perceived as more immediately aligned with employability and industry demand, and equally shaped by student preference.

Over the past decade, a substantial proportion of Engineering aspirants across India have gravitated toward computing-oriented disciplines, often assuming that Physics and Chemistry bear little relevance to careers in software development or data analytics. Such assumptions are further reinforced by placement-centric narratives that privilege short-term technical proficiency over conceptual depth. Yet this perception obscures a fundamental truth: Engineering, irrespective of its specialisation, remains anchored in the principles of basic science.

Structural foundation

Engineering education, historically, has been structured upon a foundational triad of Physics, Chemistry, and Maths. This is particularly true of the formative first year, where conceptual clarity precedes specialisation. Earlier curriculum frameworks positioned Engineering Physics and Engineering Chemistry at the beginning so that students could comprehend the behaviour of materials, energy, and systems.

These courses introduced domains such as electromagnetic theory, thermodynamics, optics, materials science, nanotechnology, and corrosion that underpin contemporary technological advancement. Their gradual dilution risks eroding the analytical rigour that distinguishes engineers from technicians. Engineers are expected not merely to execute tasks, but also to analyse, design, and optimise systems through the application of scientific reasoning.

The belief that Physics and Chemistry are relevant only to traditional "core" branches is increasingly untenable in an era of technological convergence. Semiconductor technology, which embeds the foundation of modern computing, is rooted in Solid-State Physics and Materials Chemistry. The design of microprocessors, memory systems, and communication networks depends on principles derived from quantum mechanics, electronic behaviour, and photonics.

Similarly, advances in energy-efficient computing and sustainable infrastructure draw upon Electrochemistry and Materials Science. Data centres, often perceived as abstract digital constructs, are intense physical environments governed by thermal dynamics and energy transfer. To perceive Computer Science as detached from the Physical Sciences is to overlook the very conditions that sustain digital technologies.

In a rapidly evolving technological ecosystem, the durability of scientific principles is crucial. Engineers grounded in these principles are better equipped to adapt, innovate, and interrogate underlying systems. An education that sidelines foundational science risks producing graduates who are vulnerable to technological obsolescence.

Narrowing fields

The growing emphasis on early specialisation further intensifies this concern. Students now commit to narrowly defined domains at the outset of their academic journey, often guided by market trends. While this may enhance immediate employability, it risks constraining intellectual rigour. Technological paradigms evolve rapidly, and skills that are currently in demand may soon lose their relevance.

A solid grounding in basic science equips engineers with the flexibility to cut across disciplines, engage with nascent fields, and be innovative. Many transformative developments, from quantum computing to nanotechnology, have emerged at the intersection of Engineering and Fundamental Science, underscoring the importance of preserving this foundation.

The question, hence, is not whether Physics and Chemistry should be integral to Engineering curricula but how they need to reflect contemporary relevance. Integrating application-oriented modules offers a productive approach where the learners can relate to ideas learned and applied.

Physics can emphasise semiconductor devices, optical systems, and computational modelling, while Chemistry can focus on materials engineering, energy storage, corrosion prevention, and environmental sustainability. This will preserve conceptual depth and enhance practical engagement.

As universities continue to recalibrate curricula, the marginalisation of Physics and Chemistry must be approached with caution. Their deletion will not merely streamline syllabi but weaken the very foundations of Engineering education and diminish the capacity for innovation.

In the long arc of technological progress, what is required is not the abandonment of foundational knowledge but its renewal.

Physics and Chemistry remain indispensable to the making of engineers who can design the future.

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